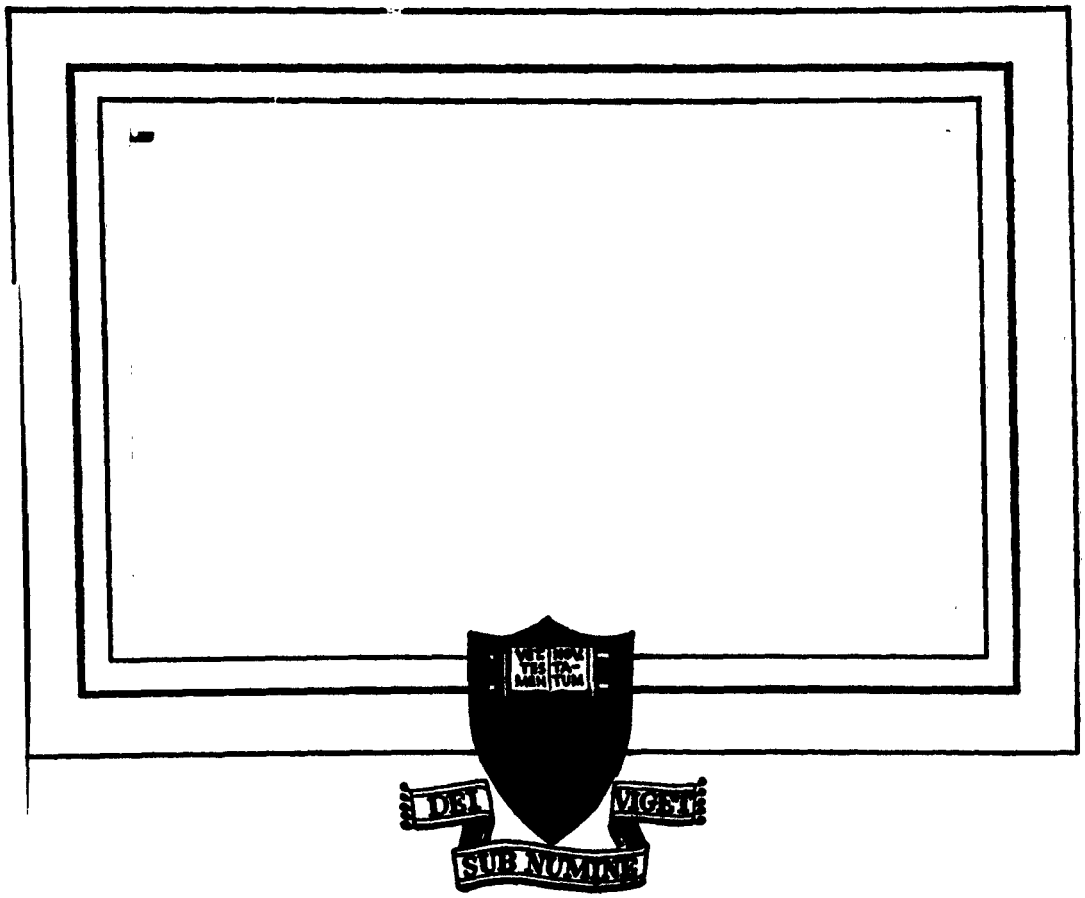

PRINCETON UNIVERSITY

Conceptual and Environmental Complexity as Factors in Attitude Change

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Princeton University

May, 1963

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Conceptual and Environmental Complexity as Factors in Attitude Change

Peter Suedfeld

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Abstract

This study was concerned with the effects of reduced environmental complexity on behavior. Many lines of research have indicated that the relationship between the amount of stimulation available from the environment and the development and maintenance of adaptive behavioral patterns is a curvilinear one, both restricted and excessive stimulation being associated with decrements in performance. Schroder, Driver and Streufert (1963) have developed a theoretical system which can be used to characterize the three major components of this relationship - i.e., external inputs, organismic dispositions, and responses. The complexity of inputs is a function of informational load, diversity, and change; that of the mediating internal processes depends upon the conceptual structure of the individual, which may range from highly concrete (simple) to highly abstract (complex); and that of the behavioral output is determined by the degree of differentiation and integration of discrete items of information in arriving at an optimal response.

Reports of Communist attempts to indoctrinate military and especially civilian political prisoners have indicated that two major methods have been used, one involving an extremely restricted environment and the other an extremely stimulating one. In accordance with the curvilinear relationship posited to exist between environmental stimulation and behavioral complexity, both of these techniques were frequently found to effect striking and far-reaching changes in the attitudinal systems of the victims. This success may be interpreted in terms of an extreme reduction in the differentiative and integrative

efficiency with which these individuals processed the "information" provided by the indoctrinators.

In the research reported here, sensory deprivation (darkness and silence) was used as an experimental analogue of the reduced-stimulation brainwashing technique. Subjects were selected to meet two criteria: a) neutral attitude towards Turkey and the Turks as measured on the evaluative dimension of a semantic differential scale, and b) conceptual structure which fit into one of the nodal levels described by Harvey, Hunt and Schroder (1961), measured primarily by a semi-projective sentence completion test. Three groups were differentiated on the basis of conceptual system functioning: extremely concrete, somewhat concrete, and somewhat abstract. There were not enough extremely abstract subjects to permit the inclusion of such a group. The attitude change stimulus was a passage composed of a strong pro-Turk argument followed by a slightly weaker counter-argument presented after 22-24 hrs. of confinement (or of relatively free activity on the part of control subjects). It was hypothesized that reduced environmental complexity (sensory deprivation) would lead to a reduction in response complexity, evidenced by a failure to integrate the opposing arguments and consequently to accept one and reject the other. This effect, measured in terms of net attitude change, was expected to be largest for the concrete and smallest for the relatively abstract subjects. The control group was hypothesized to show little, if any, attitude change, with the various conceptual-level groups changing in the same relative order as those undergoing the experimental treatment.

All of these hypotheses were confirmed. Also as predicted, the confined subjects evaluated the propaganda material more

favorably than did the control group. Another secondary hypothesis, that recall of the passage would be better in the experimental than in the control group because of differential attention, was not borne out. A possible reason for this unexpected finding was that identification of the experiment as primarily concerned with memorization of the passage may have overshadowed other motivational factors.

This research was the first to explore the effects of extreme reduction of stimulation upon the behavior of individuals functioning at the various levels of conceptual structure described by Harvey et al.(1961). It was also the first experiment to use attitude change in response to a persuasive communication as a measure of behavioral complexity as defined in structural terms. Further analysis and investigation of brainwashing techniques and results in these terms seems warranted, and several relevant experiments are proposed.

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TABLE OF CONTENTS

I. INTRODUCTION

Section I-1. Overview

The research reported here has its source in two interests. One of these is theoretical, based on reports concerning the effects of various levels of environmental stimulation upon behavior. On the whole, these studies - some of which are summarized in Section I-2 - agree that both excessively reduced and excessively intense stimulation have deleterious consequences on the course of development of young organisms as well as on the behavior of adult subjects, the relationship between stimulation level and numerous measures of behavioral efficacy being represented by a curvilinear function in the shape of an inverted U.

Section I-3 reviews some major theoretical approaches to the explanation of this relationship. Among them are adaptation level and arousal theories, which utilize the brain stem reticular formation as the neurophysiological basis underlying the effects described in Section I-2. The structural theory of Schroder and his associates (Harvey, Hunt, and Schroder, 1961; Schroder, Driver, and Streufert, 1963) is then described. The analysis of both environmental information and behavioral output in terms of complexity of differentiation and integration, and the description in the same terms of intra-organismic conceptual structures, makes this theory particularly relevant and potent in interpreting the inverted-U function and in making specific predictions concerning the relationships among individual response tendencies, situational variables, and responsive behavior.

A discussion of the other source of the research appears in Section I-4. This is a review and evaluation of the techniques, results, and theories of "brainwashing," an apparently potent system used by Soviet and Communist Chinese authorities to produce extensive and dramatic attitude change. The relevance of structural theory to this phenomenon is considered. In the present research, the experimental approach is a combination of a) the use of a laboratory analogue of one type of brainwashing situation, and b) an analysis of the environment and of its effects upon behavior in terms of structural theory, which is also used to generate the criteria for subject selection.

Section I-2. The relationship between environmental stimulation and the behavior of the organism.

A considerable body of literature has been accumulated concerning the importance of stimulation both in the normal development of the young organism and in the behavior of the adult. Studies of the effects of various amounts and kinds of stimulation upon the organism's abilities and response tendencies have established both the invidious subsequences of a restricted environment and the beneficial character of certain kinds of stimuli. The importance of varied stimulation for the maintenance of adaptive behavior has also been extensively documented.

Gross disturbances in visual perception have been found in organisms that had been reared in darkness or under conditions of diffuse light (Beach and Jaynes, 1954; Chow, Riesen, and Newell, 1957; Riesen, 1950, 1960, 1961). Restriction of the activity of the limbs during early life has resulted in

abnormal postural and motor behavior in adult animals (Nissen, Chow, and Sennes, 1951), although restriction of motor activity has generally been found to produce less disturbance than perceptual restriction (Thompson and Schaefer, 1961). Von Senden (1932) described the effects of visual deprivation (congenital cataracts) upon perception in human subjects.

More subtle restrictions of the environment are those which do not interfere with the absolute level of sensory input reaching the organism, but prevent the subject from experiencing any large variety of stimuli. The work of Clarke, Heron, Featherstonehaugh, Forgays, and Hebb (1951) and of Melzack and his associates (Melzack, 1954, 1963; Melzack and Scott, 1957) has established the unadaptiveness of the responses emitted by dogs reared in restricting cages when they come into contact with novel stimuli. Response to pain, for example, even when the animal clearly indicates that the stimulation has been perceived, does not take the form of successful escape or avoidance. More striking, perhaps, is the extremely high level of excitement ("freezing" followed by rapid, highly active but apparently random exploration) evidenced by these dogs when they are first permitted to enter a new environment (Melzack, 1963), and the similar behavior of "restricted" rats upon being introduced into a maze (Woods, Ruckelshaus, and Bowling, 1960).

A concomitant behavioral result of restricted rearing is impaired learning ability. Rats reared in small cages have been found to perform at an inferior level on maze problems (Bingham and Griffiths, 1952; Hymovitch, 1952; Forgays and Forgays, 1952). Irrelevant response patterns in a discrimination situation fail to be inhibited, while there is generally

greater difficulty in learning visual discriminations (Melzack, 1963). "Restricted" dogs also fail to selectively attend to innocuous but threatening visual and auditory stimuli (Melzack, 1963).

Isolation has often been shown to have effects similar to those of sensory stimulus reduction. Beach and Jaynes (1954) and Melzack (1963) have shown the inappropriate sexual behavior of insects, birds, rats, and dogs which had been reared in isolation: these responses include immature sex play, failure to respond to the call of other members of the species, inability to discriminate (though not to perceive) sexually relevant cues, etc. Rearing animals in isolation also makes them less viable when stressed (King and Connor, 1955), and such animals often display the diffuse, random activity which has been noted in subjects reared in sensorially restrictive environments (Beach and Jaynes, 1954). They are less gregarious than animals reared in communal cages (Beach and Jaynes, 1954) and are more disturbed and submissive in competitive situations (Scott, 1950; King and Gurney, 1954).

Temporarily isolated animals have also given evidence of behavioral and emotional disturbances (Köhler, 1927; Nissen, 1951). Further, it has been demonstrated that animals undergoing a stressful approach-avoidance conflict situation develop gastric ulcers more rapidly if they experience this situation alone than if they are with others (Conger, Sawrey, and Turrell, 1958; Sawrey and Weisz, 1956). Mason (1960) has shown that when faced with an emotionally disturbing stimulus, monkeys become less emotional in the presence of another monkey - even an unfamiliar one. Davitz and Mason (1955) have reported a similar reduction of open-field fear responses in rats when

an unafraid rat was also present.

The effects of restricted environments during human childhood have of necessity been less extensively investigated. The studies of Dennis and Dennis (1951) stand alone in even approximating deliberate definition of the parameters of restriction. These researchers greatly reduced the normal amount of social interaction and the availability of manipulatable objects (e.g., toys) in rearing twin girls until the age of 13 months. The experimenters did not reinforce any activity of the infants, did not give them toys until the 49th week, and did not smile at them or play with them until the age of 26 weeks. The children were kept indoors; when they had to be taken out of the house for physical examinations or other reasons, their faces were covered. It should be noted that there was nothing even approaching social isolation or complete environmental impoverishment. No emotional disturbances were found during the period of the study, and unfortunately there was no follow-up to examine the social, cognitive, and emotional development of the subjects. However, even during the period of the research the children were found to be abnormally slow in developing some complex motor activities: sitting alone, standing with support, and visually directed reaching and grasping. These deficiencies were not due to muscular weakness or lack of exercise, since diffuse motor activity was almost continuous when the children were awake.

Spitz (1945, 1946 a,b) and Goldfarb (1955) have discussed the effects of institutionalization on children. Generally, individuals whose infancy was spent in the institutional environment, which is relatively poor in both social contacts and in variability of physical surroundings, have shown signs of low intelligence and abnormal passivity

and dependence (cf., the submissiveness of dogs reared in restricting cages, Melzack, 1963). Goldfarb (1955) has described the personality of children who had spent their first year of life in almost complete isolation and their second and third in a restricted institutional setting: these children, when compared to a control group of similar family origin but reared with foster families, were less intelligent, had lower conceptual ability (giving more concrete responses on categorization tasks), and showed signs of intellectual and emotional impoverishment. They were passive and apathetic, but at the same time hyperactive and restless. They showed little affection for others (cf., the lack of gregariousness and withdrawal from social stimuli of chicks and ducks reared in isolation - Beach and Jaynes, 1954). Isolation and confinement of "unwanted" children has been shown to have similar deleterious cognitive and emotional results (Davis, 1940, 1947). The work most purely concerned with social deprivation in children, that dealing with lack of mother-child interaction, will not be considered in detail here, since it concerns the importance of only one specific source of social stimulation; but the results of such deprivation are comparable to those following general social or sensory stimulus restriction (Ribble, 1943, 1944; Foss, 1961). The behavior of autistic and feral children also seems to be related to these kinds of deprivation (Gewirtz, 1961; Bettelheim, 1959), and it is interesting to note that the response of autistic children to painful stimulation (Kanner and Eisenberg, 1955) closely resembles the unadaptive responses of restricted dogs (e.g., Melzack, 1963). Another similarity is the inability of restricted children (Goldfarb, 1955), as well as of dogs (Thompson and Heron, 1954), to inhibit or delay responses.

Isolation in childhood has also been mentioned as a causative factor in alalia (Kainz, 1960) and apparent mental deficiency (Kratter, 1959).

A great amount of work published during the past ten years describing the effects of sensory deprivation (isolation under conditions of either reduced patterning or reduced level of sensory input) gives evidence of disturbances in the functioning of adults placed into such restrictive environments. A detailed review here is not necessary; let it suffice that decrements have been found in perception (Heron, Doane, and Scott, 1956; Bexton, Heron, and Scott, 1954; Freedman, Grunebaum, and Greenblatt, 1961; Vernon, McGill, Gulick, and Candland, 1961); visual-motor coordination (Freedman et al., 1961; Vernon et al, 1961); and cognition (Scott, Bexton, Heron, and Doane, 1959; Cohen, Silverman, Bressler, and Shmavonian, 1961; Goldberger and Holt, 1958; Suedfeld, Grissom, and Vernon, 1963). Other evidence of disturbed functioning, such as hallucinations (Bexton, 1953; Wexler, Mendelson, Leiderman, and Solomon, 1958; Freedman et al., 1961) and abnormal affect, including regressive phenomena (Goldberger and Holt, 1958; Lilly, 1956; Azima, Vispo, and Azima, 1961) have also been reported.

Isolation without reduction of the amount of patterned or total stimulation also has disturbing effects on human adults. The most dramatic literature here is anecdotal (see Leiderman and Stern, 1961), dealing with the experiences of shipwrecked sailors, prisoners in solitary confinement, explorers alone in the Arctic or Antarctic, and individuals accomplishing long journeys in one-man boats or aircraft. Generally, the effects of such experiences include disturbances in attention and in organization of thought, labile and extreme affect, halluci-

nations and delusions, etc., all of which are similar to those reported by subjects in sensory deprivation experiments (see Kubzansky, 1961). Bovard (1959), in reviewing the literature concerned with isolation and stress in human beings, came to the conclusion that both children and adults responded more adaptively to stressful situations when they were with others than when they were alone.

The detrimental effects of insufficient stimulation, social or sensory, are thus well established. The study of the effects of "enriched" environments also indicates the importance of stimulation in the development of young organisms. Copious work on gentling and handling has shown that these treatments in early life have generally beneficial effects upon the adult animal's resistance to food deprivation (Weininger, 1953), water deprivation (Levine, 1957), and a variety of other stressors (Newton and Heimstra, 1956; Weininger, 1956; Ader, 1959). Behaviorally, gentled animals show less emotionality in novel environments (Ader, 1957, 1959; Levine, 1959; Levine, Chevalier, and Korchin, 1956; etc.). Superior performance on learning tasks was shown by gentled subjects in discrimination problems (Bernstein, 1952) as well as in escape and avoidance learning (Barry, 1957; Levine et al., 1956). Handled animals have also been demonstrated to be dominant in situations involving social competition (Levine, 1959; Rosen, 1958) - in contradistinction to the submissive restricted animals of Melzack (1963) and King and Gurney (1954).

Similar beneficial effects have been ascribed to moderate thermal stress (King and Connon, 1955; Newton and Heimstra, 1960), being repeatedly thrown in the air (Ader, 1959), and

low-intensity electric shock (Denenberg and Bell, 1960; Mogenson and Ehrlich, 1958), all of which may, like gentling, be conceived of as moderately unpleasant experiences (Candland, Faulds, Thomas, and Candland, 1960; Levine et al., 1956; Levine, Alpert, and Lewis, 1957; Ader, 1959). Animals reared in environments richer in manipulatable objects and varying structures than the standard laboratory cage have been shown to be superior in maze-learning ability (Forgays and Forgays, 1952; Brigham and Griffiths, 1952; Hymovitch, 1952).

The social counterpart of the moderately enriched environment may be communal rearing and housing. Winokur, Stern, and Tailor (1959) have shown that the effects of communal training are much like those of being handled during infancy, and mice reared in communal cages have proven more viable under stress than those reared alone (King and Connon, 1955) - although Griffiths (1961) considers isolation to be similar to handling in its effects, describing both situations as mild stressors which result in increased resistance to future stress. As will be shown, evidence seems to indicate that it is the degree of stressfulness which determines whether an experience is to have adverse or beneficial results, and the same manipulation may represent different levels of stress for different organisms at different times in life.

With human beings, the consequences of enriched early environments are difficult to evaluate. Unlike the world of the laboratory animal, which is normally quite circumscribed and can easily be made more varied, the surroundings of the normal human infant are highly stimulating. However, there is some evidence that nursery school attendance and special types of enriching experience can have beneficial effects upon young children in regard to both social behavior and intelligence

(Thompson and Schaefer, 1961).

A closer study of the effects of environmental "enrichment" discloses a further interesting fact. Although, as outlined above, stimulating environments usually appear to have advantageous results, excessive enrichment may have disturbing effects similar to those of excessive impoverishment.

Such findings have been obtained with some of the same environmental manipulations which have been described above. For example, Denenberg (1959) found that mice which underwent moderate electric shock (.2 or .5 ma) during infancy learned more efficiently than did mice getting either no shock at all or more intense shock (.8 ma). The same result was reported by Denenberg and Bell (1960). Handling, too, appears to reach an optimal level in its beneficial consequences for later behavior. Brooker (1955) found that while rats handled for 5, 10, or 20 minutes per day for 21 days all showed greater weight gains than an unhandled control group, the maximal gain was registered in the 10-minute group. Denenberg and Karas (1960) reported that animals handled for 10 minutes per day learned an avoidance response more efficiently than either no-handling or 20-minute handling groups. Furthermore, the 10-minute subjects survived the longest when placed on terminal food and water deprivation (Denenberg and Karas, 1959, 1960). Griffiths (1960) stated that both isolated and stressed (with intense light, noise, and shock) animals had higher shock thresholds than did normally reared subjects (cf., Melzack, 1954, 1963). Grissom (1963) has reviewed the effects of electro-convulsive shock upon retention, and concluded that these effects are universally detrimental. Thompson and Schaefer (1961) cited studies which documented the causative

role of infantile overstimulation in enuresis and feeding problems in children. Although pain thresholds of human adults are elevated during sensory barrage (Green, 1962) and depressed after sensory deprivation (Vernon and McGill, 1961) - for which difference the variation in the temporal relationship between manipulation and threshold measurement may be at least partly responsible - the subjective reports of individuals in the two situations sound very much alike (cf., Green, 1962; and, e.g., Heron, 1961). Comparable findings have also been obtained in studies of sleep deprivation, presumably a high-stimulation technique (Tyler, 1956).

Only the general trends of research findings have been considered in this discussion. Results and theorizing which seem to fairly represent the consensus were covered, to the exclusion of the relatively few experiments and theoretical formulations which have been at variance with the majority of reports - for example, Bernstein's "friendliness" explanation of gentling (1952), and Griffiths' reports that isolation and intense stimulation in infancy are respectively beneficial and innocuous (Griffiths, 1961; Griffiths and Stringer, 1952). In fact that these and similar findings were not discussed does not mean that they are in some way less "valid" than those which represent the major part of the literature. The subtle interactive effects of genetic and individual differences, age of subject at the onset of environmental manipulation, duration, type, and intensity of the manipulation, and many other variables (see Beach and Jaynes, 1954; King, 1958; Thompson and Schaefer, 1961) which are sometimes difficult to identify and even more difficult to control, make it understandable that different experimenters, even when using similar experimental designs, do not arrive at unanimous conclusions.

The even greater subtlety of social stimulation makes the expectation of authoritative agreement in this field a forlorn hope. Individual differences are extremely important, and social stimuli have much more complex and important concomitants than would be predicted from a consideration of their characteristics qua stimuli. Nissen (1951) pointed out that they are highly variable and unpredictable, they interact in complex and subtle ways with the environment and the organism, and often arouse strong affective responses. The identity of the social stimulus and the nature of the interaction are of paramount importance in determining the behavior of the subject. In many studies, social stimulation and general environmental stimulation are restricted or intensified together, making it difficult to ascribe any particular behavioral resultant to one or the other (e.g., the work of Melzack and associates, referred to on p. 3 et seq., and the studies in sensory deprivation mentioned on p. 7). It may even be difficult to evaluate the relative importance of the social and sensory aspects of a given stimulus, such as the mother surrogates used by Harlow (1958) and the objects used in studies of imprinting (Scott, 1962). In addition, the absence of others may not be sufficient to arouse feelings of isolation in human adults (Schein, 1961a); nor, on the other hand, is the presence of others a guarantee against such feelings (Fromm-Reichmann, 1959).

On the whole, the experimental and clinical literature indicates that there exists a level of environmental stimulation which is correlated with optimal development and behavior on the part of the organism. When the level of stimulation available is greatly removed from this optimal zone, in the direction either of under- or over-stimulation, developmental and behavioral decrements are usually observed. Figure 1 is a

representation of this relationship between environmental stimulation and behavioral efficiency. While the exact shape of the function is yet to be specified, and the various zones and points along the axes can be labelled only in vague qualitative terms, it is justifiable to state that this inverted U is a generally accurate description of the relationship. The experimental evidence which was described in this section may be classified in terms of the environments used, and located on the abscissa of Fig. 1 as follows: severely restricted and isolated conditions towards the left of zone R; the standard laboratory cage and the mildly restricting conditions of brief isolation in the part of zone R approaching the optimal point; normal or slightly enriched human environments and the handled or otherwise moderately stimulated conditions used with animals centered around the optimal point; severely stressful and intensely stimulating environments in zone E.

It is once again emphasized that no specific level of stimulation has the same value for all organisms, and that the function described in Fig. 1, while it holds for <u>each</u> individual subject, cannot be used for inter-subjective comparisons without a more detailed description and control of individual differences.

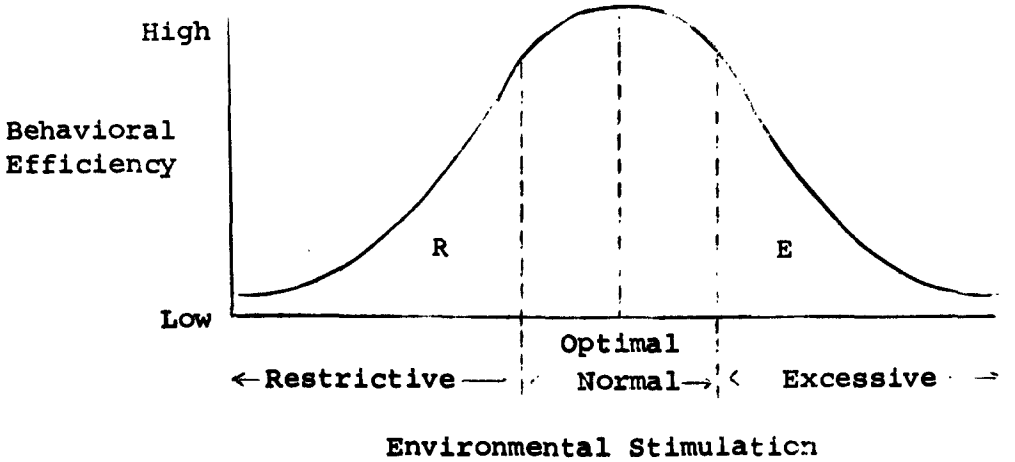

Fig. 1. The relationship between environmental stimulation and behavioral efficiency.

Section I-3. Theoretical approaches: arousal, adaptation level, and structural complexity.

The majority of theoretical explications of the relationship represented in Fig. 1 use arousal or activation as the mediating link between environmental input and behavioral output. This type of explanation is often based upon the nature of the brain stem reticular formation, which has been shown to have important roles in perception, learning, and emotion (see Magoun, 1958; Jasper, Proctor, Knighton, Noshay, and Costello, 1958). The ability of the reticular activating system to either increase or diminish cortical activity in response to external stimulation (Moruzzi and Magoun, 1949), and the role of the cortex in exciting the reticular formation which then in turn reflects the changed level of arousal back upon the cortex itself (Lindsley, 1961), make this structure a very appropriate one for such theorizing. In this way, one can explain not only the research cited in Section I-2 concerning the effects of external stimulation upon behavior, but also the copious work relating performance to the degree (although not the kind) of emotional arousal. This latter relationship apparently is also accurately represented by the inverted U (Fiske and Maddi, 1961; Malmo, 1959; Schlosberg, 1954), so that theorists attempting to explain the external stimulation-performance relationship can, by invoking the reticular formation, also explain the similar relationship between internal arousal and performance via the same mediating instrument.

Malmo (e.g., 1959) describes the activation continuum as extending from deep sleep at the low end to extreme excitement at the high, performance level following the inverted-U function

and coming to optimum at a moderate level of activation. He relates activation to cortical bombardment by the reticular activating system. At low levels of bombardment, there is not enough cortical arousal to reach optimal performance. When the bombardment rate becomes excessive, neurons may acquire relatively high thresholds and cease responding to every stimulus; this failure to transmit some impulses may in turn deactivate entire cell assemblies, leading to performance decrements. According to Malmo, activation corresponds to Hull's "general drive" (D).

A similar identity between D and arousal level is proposed by Hebb (1955). Arousal, determined by reticular activity, is a general energizing function. Hebb considers any sensory event to have two effects: one is the arousing function and the other is a cue function which serves to guide behavior. Thus, the ordinate of Hebb's version of Fig. 1 would be labeled "cue function"; and it is the cue function of a stimulus which does not operate in low-arousal states such as sleep, becomes increasingly effective until arousal reaches a moderate level, and is less and less important as high arousal and emotional disturbance evoke conflicting response tendencies and lead to maladaptive behavior.

This view is seconded by Easterbrook (1959), although without the use of the term "arousal." Easterbrook emphasizes the utilization of cues, and the relationship of this utilization to levels of drive and emotion. At relatively low levels of drive and emotion, many cues - including irrelevant ones - are considered by the organism in making its response. As drive level becomes higher, attention is focussed upon relevant cues only, leading to more proficiency in the response; but as cues are increasingly disregarded as a function of greater urgency in the drive or emotion, a point is reached when all

irrelevant cues have already been excluded and the subject begins to ignore relevant cues. From this point, performance becomes decreasingly efficient.

Schlosberg (1954) relates emotion, as a concomitant of physiological arousal, to performance efficiency. Measuring arousal by skin conductance and muscular tension, Schlosberg places sleep at the low end of the arousal continuum, with alert attention at the moderate, optimal point and strong emotion at the high, disruptive end.

Closely related to the arousal or activation theories are those using adaptation level as a basic concept. Again, most of these systems depend upon the reticular formation as the critical neurophysiological substratum. The adaptation level is that rate of stimulation input which is optimal to the organism, and to which it has become accustomed. This type of theory seems to take individual differences into consideration more than was the case with arousal theories, although these differences are thought of purely as experiential ones determined by the rates of stimulus input which the organism has met in the past. The differential effects of various types of stimulation, and deeper-going personality changes caused by experience which later serve to determine responses are ignored.

Helson (1959) differs from most of the theorists under consideration in rejecting the concept that sub- and super-optimal levels of stimulation both produce negative changes in behavior. In his theory, adaptation level represents a neutral equilibrium, the behavioral equivalent of physiological homeostasis, whose maintenance depends upon the interaction of all stimuli presently confronting the organism (simultaneous pooling) and between these and past experience (successive

pooling). The specific behavioral consequences of under- or over-stimulation vary according to the situation and the organism; however, behavior is bipolar. That is, if overstimulation evokes one type of response in any given case, understimulation will evoke the direct opposite of that response.

Other adaptation level theorists, however, have supported the validity of the inverted-U function. Leuba (1955), for example, defining the optimal level of stimulation as dependent upon the total stimulation existing at the moment and the immediately past level of stimulation, says that "...changes from either minimal or excessive stimulation toward an optimal level tend to be experienced as more satisfying and pleasant than those involving changes in the opposite direction..." (pp. 30-31). Thus, even painful stimuli can be pleasant if they change the overall level of stimulation from below-optimal toward optimal.

Dember and Earl (1957) define an "optimal complexity value" in reference to exploratory behavior. Environments which provide this degree of complexity (the optimal value varying from organism to organism) are "pacers," which are attended to in preference to stimuli which are either more or less complex.

Lindsley (1961) agrees that sensory deprivation and sensory overload have similar effects. The reticular formation adjusts to a certain level of incoming and outgoing message flow, and this adaptation level limits its ability to deal with widely deviating conditions. Thus, under either extreme restriction or extreme overload, behavior becomes disorganized and negative affect is aroused. This view is supported by Fuster (1958). He found that when the reticular formation was electrically stimulated prior to the presentation of a difficult learned discrimination task, performance became more rapid and accurate;

if the stimulation were unduly prolonged, however, this gain was negated. According to Lindsley, there is a similar effect with sensory distortion (e.g., delayed auditory feedback): the matching of sensory, motor, and conceptual systems is disturbed, the pattern of firing in the reticular activating system undergoes a radical change, and behavioral and affective decrements result. Thus, Lindsley is one of the few theorists who explicitly considers differences in the kind as well as the level of stimulation as related to the reticular formation, adaptation level, and behavior.

In their recent book, Fiske and Maddi (1961) have drawn together a large number of findings and theoretical formulations relating to the question of the relationship between stimulus level, stimulus variation, and behavior. They support the reticular formation's role as the neurological mediator in activation, and assert the significance of the inverted U curve in describing the relationships between activation and performance. They hypothesize that the organism is motivated to maintain the total impact of the current environment at its accustomed or characteristic activation level. When the attempts at maintaining this level are unsuccessful, negative affect is experienced; a shift toward the normal level of activation results in positive affect. Activation is described as the resultant of the total impact of current stimulation, and includes exteroceptive, interoceptive and cerebral stimuli - that is, any stimulation which is able to reach the reticular activating system. The intensity, meaningfulness, and variation of a stimulus determine its total impact. This theory is somewhat more explicit in its definitions than most of the others we have considered, particularly in its attempt to identify those aspects of a stimulus

which are relevant to its effect on arousal and adaptation level. However, the total impact of a stimulus situation seems to be extremely difficult to evaluate, particularly as the three contributing effects and their complex interactions within one specific stimulus, as well as the import of that stimulus within the environment, may well be completely different from subject to subject and from situation to situation.

The main strength of arousal and adaptation level theories seems to be in their general applicability. They are relevant to all organisms and all environments. It is perhaps this very universality which also represents one of their primary weaknesses, since in order to achieve it the theories must sacrifice the ability to define the specific parameters which determine the variability of actual behavior. For example, such theories would be hard put to explain why sensory deprivation has adverse effects upon some complicated cognitive responses (Suedfeld *et al.*, 1963), no effects upon others (Zubek, Sansom, and Prysiaznuik, 1960), and beneficial aspects for still others (Grissom, 1963). In the same way, the wide differences in individual responses to such situations cannot be predicted; at best, a *post hoc* explanation in terms of accustomed level of stimulation could be advanced.

A somewhat different approach to the problem of identifying relevant stimulus variables has emphasized the importance of information to the organism. The motivational value of information has been shown by Jones (1961; Jones, Wilkinson, and Braden, 1961) and Miller (1960), in reviewing over one thousand articles, has found the curvilinear function to be descriptive of the relationship between information flow and efficiency of information processing. According to Miller,

this relationship holds true at all levels of information-processing systems, from a single neuron through organ systems, individuals, and groups, to social institutions.

Glanzer (1958) cites the difference between the information processing capabilities of the organism and the amount of information available to it in any given environment as being responsible for the effects of restricted early stimulation. That is, an animal which in early life experienced only low levels of information input, and developed little capacity or need for processing information, cannot easily adapt to the excessively high flow of information which impinges upon it in a test situation.

It is obvious that the formulations of Hebb (1955) and Easterbrook (1959), cited on pp. 15-16, are in agreement with this view. The "cue function" of the stimulus is an information function, and the behavioral effect of arousal and emotion is reflected in the inverted U shape of the processing efficiency function. Easterbrook quite explicitly describes cue utilization - i.e., information processing - as a function of drive and emotional arousal. Schaffer (1954) holds that under stress (high arousal) subcortical brain centers become dominant in guiding behavior, and that in such situations many effective methods of information processing are abandoned for less adaptive means such as stereotyped superstitious behavior. Fiske and Maddi's stimulus "impact" (1961), being a function of intensity, meaningfulness, and variation (which includes complexity and unexpectedness), may be interpreted as to some degree representing the information value of the stimulus situation, and Bruner's (1961) explanation of the effects of sensory deprivation is similarly based upon cue utilization and information processing. Early restriction

prevents or hinders the development of strategies which would enable the organism to attend to the informational aspects of the environment, select the most relevant ones, and draw inferences in accordance with some model of the environment which would adaptively guide its behavior. Not only is a heterogeneous environment vital for the development of such information processing, but the results of the work in sensory deprivation show that the maintenance of the process may be disturbed by brief periods of reduced stimulation in adulthood.

Conceiving of the organism as an information processing mechanism was one step towards a comprehensive explanation of the input-output relationship. Three major problems remained: the ordering of stimuli according to some systematic dimension, a means of utilizing individual differences as predictive factors, and a typology in which a great number of varying behaviors can be compared. Since the stimulating inputs involved in the relationship can range from electrical impulses to "enemy action" in competitive games, the responses from a bar press to the generation of complicated strategies, and "organisms" from a neuron to a nation, it is necessary for any adequate explanation to utilize concepts which can include this great range from the very simple to the enormously complex.

One theoretical system which makes this possible, and the one upon which the present study is based, is that of Schroder and his associates (Harvey, Hunt, and Schroder, 1961; Schroder, 1963; Schroder, Driver, and Streufert, 1963). In this system, both environmental and organismic variables may be ordered along a dimension of complexity, so that all three of the evaluation problems mentioned above can be handled by having recourse to the same single general characteristic. The use

of structural rather than content variables is a vital advantage of this approach. The wide range of environments and organisms, which limits the predictive and explanatory value of the other theories, is not an insurmountable handicap; situational and personality characteristics which vary greatly in content may nevertheless be ordered along a structural complexity dimension. This eliminates the impossible task of classifying, measuring, and specifying the interrelationships among the myriads of organisms, personalities, situations, performances, etc. Another important aspect of this theory is its emphasis upon and clear explanation of the mediating processes which link environmental stimulation to behavior.

So far in this discussion, there has been little clarification of the role of individual differences, which is probably the most difficult variable to evaluate systematically in the consideration of the effects of environmental characteristics upon performance characteristics. It is here that the theory of Schroder et al. is the most explicit and detailed. The significant aspect of personality which mediates between input and output is conceptual complexity, conceived of structurally and defined in terms of differentiation and integration of information. Species differences, as well as individual differences, can be classified in this way; however, for the purposes of this discussion only the latter are relevant.

Conceptual structure refers to mediating cognitive links which the person uses to map his environment and to generate optimally adaptive courses of action. This structure determines "...patterns of information search, the kinds and diversity of information a person generates about the environ-

ment, [and] the number of different ways he can organize the information for decision making purposes...." (Schroder, 1963, p. 2).

The basic parts of the mediating structure are the dimensions along which stimuli can be ordered; and the number of these dimensions determines the degree to which the individual is able to fully consider complex informational inputs. The ability of the person to thus utilize the varying dimensions of environmental information is his level of differentiation. For example, a simple organism may use only the brightness dimension of light as a determinant of its response, whereas a more advanced species can differentiate the dimensions of hue and saturation as well as brightness. On a social level, a structure with low differentiation may focus on skin color to characterize a given individual, while a more highly differentiated system may also attend to dress, speech patterns, etc. In performing an experimental task, subjects at lower levels of differentiation may ignore all but one or a few of the relevant stimulus characteristics.

The second important way in which conceptual systems vary is in terms of the complexity of the rules or schemata for organizing dimensions of the information received. At any given level of differentiation, these integrative schemata may differ widely. Where only one dimension has been differentiated, or where instructions focus attention on only one dimension (e.g., "Put objects of the same color together"), the opportunity for complex integration is low; but as a rule, many schemata can be used - if available - in most situations. Again, individuals differ in their ability to integrate informational dimensions: people with an extremely small number of integrative schemata, for example, may not be

able to evaluate a person or situation about which they have contradictory information except by rejecting some of the information given, whereas a more highly developed integrative system could explain the existence of the contradiction by weighing and combining the various items of information.

The detailed exposition of the training and developmental factors which is given in Harvey et al. (1961) is not relevant at present; briefly, training conditions which lead to the development of given levels of conceptual complexity, and result either in further development or in arrestation at that level, have been described, as has the generally saccadic course of development which under optimal training conditions may result in an extremely high level of differentiation and integration.

Harvey et al. (1961) have used the terms "concrete" and "abstract" to identify the ends of the continuum of conceptual complexity: concrete functioning is associated with low complexity, abstract functioning with high. They have further identified four separate specific points on the concrete-abstract continuum as nodal stages, the course of development (if not arrested) being from the most concrete (System I) to the most abstract (System IV). In view of the fact that the characteristics of functioning at each level, and the relationship of the classificatory scheme to those of other theorists has been described in detail in many places (Harvey et al., 1961; Janicki, 1960; Streufert, 1962; Tuckman, 1963; Schroder et al., 1963), only a brief description will be given here.

At the concrete end of the continuum lies System I functioning. At this level, conceptual schemata are global and undifferentiated. The individual is able to categorize stimuli into dimensions, but he lacks organizational rules

whereby he could establish relationships among these dimensions. Information tends to be mapped along a single dimension, and conflict or ambiguity are difficult to resolve except by excluding some of the available information from consideration. There is also a tendency to categorize stimuli into bipolar classes (e.g., good-bad), with little discrimination of subtle differences. The system is relatively rigid, and is not open to change either in response to new information or via consideration of other aspects of the stimulus; that is, once a stimulus is categorized along one dimension, its place will not be changed by an inconsistent categorization along another dimension. The major concern of such a system is the development of rules for categorizing stimuli and for the maintenance of order and of clear structure. Behavior is controlled by extreme dependence upon external anchors. Ambiguity and conflict are warded off as long as possible; when this mode of defense fails, the stimulus is abruptly re-categorized in an all-or-nothing, rather than a gradual, fashion.

System II functioning is somewhat less concrete, having developed some differentiation of schemata. However, these schemata are used as alternatives; that is, if two are available, one may be primarily considered in one given type of situation and the other in other types of situations. This is a primitive organization, in which there is no possibility of using interrelationships between the various schemata in accordance with superordinate concepts. Although it does not permit any great complexity in organizing information, it does at least allow a greater degree of choice and indeterminacy than was possible in System I. It must be noted that since one schema is relatively independent of and unrelated to any

other, the discrimination of any stimulus within any dimension of evaluation still tends to be somewhat categorical, and not much affected by its place along other dimensions. Within this dimension, however, there exists a larger number of finer discriminations than could be generated at the more concrete level of functioning. Internal referents begin to emerge in this system, and dependence upon external guidelines becomes less absolute. Information is still not evaluated in all of its complexity, since those inputs which are relevant to schemata not being used in the particular situation are relatively ineffective and lose much of their value. Since there are neither absolutistic rules for organizing information and behavior nor complex methods which would utilize all possible information to arrive at strategies, decision making and behavior are often inconsistent. A lack of commitment ("weak superego") may be the observable result of the alternate use of conditional schemata.

Further toward the abstract end of the continuum lies System III functioning. At this level, schemata can be used in combination. A set of superordinate rules has been developed, and is used for matching or comparing small numbers of schemata at a time. All of these schemata are then considered in mapping the stimulus and in deciding upon an appropriate response. This system is less deterministic than Systems I and II, being able not only to generate a number of sets of criteria for interpretation but also to consider several of these sets simultaneously; the number and range of stimuli which can be evaluated and of decisions which can be made are therefore greatly increased. Empathy and self-awareness are greatly enhanced by schematic combinations which enable the individual to put himself in the place of others and to see himself as

others see him. Functioning is to a great extent determined by internally derived rules which can be used not only to consider past and present evaluations but can also project into the future. "Functioning is decreasingly dependent upon immediate external stimulus conditions and behavior...is decreasingly predictable from a knowledge of past experience and the external situation " (Schroder et al., 1963, p. 34).

In highly abstract System IV functioning, the number of schemata which can be considered at one time is greatly increased by the evolution of complex higher-level rules. Not only can two (or a few) schemata be compared, as in System III, but there exists the possibility for complex alternate combinations as well as comparisons. Alternate patterns of complex interactions can be generated, and a greater diversity of information can be handled. Regardless of external conditions, alternate organizations of schemata can be produced by internal processes; they can be used for mapping whatever information is available and for arriving at action plans directed towards dealing with the situation, acquiring more information, or both. Uncertainty and lack of external structure, rather than being disruptive as in concrete systems, may be rewarding if they offer novelty and information. At the same time, a relative lack of environmental information, while possibly unpleasant, is not distressing, because of the ability of the individual to utilize to the utmost any information which is given and to make use of a rich set of internal referents.

It must be made clear that this fourfold categorization is not intended to be a final and absolute system of classification. Not only are there gradations of complexity within each of the four nodal systems, as well as differences in complexity

related to situational factors, but there are also transitional levels between the nodal systems. The use of the systems described above is a pragmatic one, which identifies relatively common points along the concrete-abstract continuum; and while it is admitted that many individuals may fit on points outside the four common ones, the use of the fourfold classification has been found to be useful for the purposes of efficiency in measurement and selection.

Schroder's theory further describes environmental and behavioral characteristics as they are related to conceptual complexity. Environments are classified in terms of their effects upon the complexity of the mediating processes; that is, two environments which have the same effect upon conceptual functioning may be categorized as similar, regardless of differences in actual situational contexts. Thus the problem mentioned before, that of ordering an infinitely great variety of stimulus situations along some meaningful and useful dimension, is solved by relating these situations to the cognitive variable which is the foundation of the theory.

The most directly relevant characteristic of the environment is informational complexity (Schroder *et al.*, 1963). Actually, this is an attribute composed of the combination of three variables: informational load, informational diversity, and rate of informational change. Specific situations can be evaluated in terms of these variables by considering such factors as amount of information available (e.g., in sensory deprivation *vs.* in sensory bombardment), the variability of the situation, the number of behavior patterns which are "correct" in the situation (i.e., whether there is only one right answer, or many alternate solutions),

the familiarity or novelty of the situation, and the nature of the goal - for example, is the goal fixed and unchanging or, as in complex gaming situations, can there be alternate and emergent goals. The similarity of this dimension to the "impact" variables of Fiske and Maddi (1961) is notable; the novelty - and value - of Schroder's formulation lies in the explicit statement of the relevance of these situational characteristics to behavior, via a systematized set of personality-derived substrates.

There also exist situational variables which do not affect the complexity of the environment per se, but do influence the way in which the individual handles incoming information. Again, these variables should be conceived of in light of their relevance to the conceptual complexity continuum described previously.

One of these characteristics refers to the "set" and orientation effects of the available information. For example, cost-reward factors can strongly influence the complexity of functioning: when reward is insufficient, or possible negative consequences extremely severe, information processing is less than optimal due to disinterest in the one case and emotional arousal in the other. Situations which are experienced as refuting - i.e., dissonant or incongruent information - or which are disorienting (delayed auditory feedback, weightlessness, aniseikonic vision) may sensitize the individual to threat and again result in less abstract behavior.

Another property of the environment which indirectly affects complexity of behavior is the necessity for such complexity. In group situations, for example, such factors include the number of individuals taking part, the degree of interaction required, the necessity for cooperation in order to reach the group goal, and pressures towards or away from

diversity within and among groups. In other situations, one must consider the necessity for the generation of alternate plans in order to arrive at a solution, the existence and efficacy of externally provided rules for behavior, the reward value of exploratory behavior, the need for generating and integrating diverse information, etc. As Schroder indicates, "To the extent that originally complex task environments can be simplified...higher levels of information processing are no longer required for 'good' performance" (1963, p. 1).

Behavior can similarly be characterized according to the variables related to the basic theoretical concepts. The major dimensions along which behavior is viewed are differentiation and integration: the number of units of information generated by the organism in any given situation (i.e., the extent to which the organism explores the possible informational components available to it), and the extent to which units or dimensions of information are related and organized in the generation of new information and new strategies. This aspect of behavior can be measured in several ways: the combinatory use of past and present information in making decisions, the number of alternate response possibilities which the subject sees as inherent in a set of incoming stimuli, the development of channels of authority and communication in a group, etc. The specific behavioral characteristics which are derived from the two primary variables include discrimination, or the degree to which different stimuli can be identified; absoluteness, which is related to all-or-nothing dichotomous evaluation, to rejection of the out-group, and to aggressive conventionality; the degree to which behavior is anchored in external referents; tolerance

or intolerance of conflict and ambiguity; the extent to which strategies are flexible and can be changed in accordance with new information; the degree to which evaluation of one aspect of the stimulus is generalized to the total evaluation of that stimulus, etc. The classical defense mechanisms, such as projection, and resolution processes such as leveling and sharpening, can be related to the types of variables described above, and can be characterized in terms of structural referents.

In the general relationship between environmental and behavioral complexity, cognitive structure being held the same, Schroder and his co-workers agree that the curvilinear function is an accurate representation. "As the environment (a) becomes simpler (stimulus poor or reacted to in a fixed way) or (b) becomes overly complex, structural regression occurs....Simple environments do not contain enough information to generate or warrant high levels of integrative complexity. Very complex environments contain too much information. If the information is assimilated it is too difficult to integrate via complex rules and if it is selectively assimilated (but still complex) it may be impossible to meaningfully integrate." (Schroder, 1963, pp. 12-13). In other words, when information flow is either restricted or excessive, the conceptual complexity of the mediating schemata is reduced, with a consequent reduction in the complexity of the response. The axes of Fig. 1 are re-labeled, with behavioral complexity along the ordinate and environmental complexity on the abscissa, although the new names indicate a change only in the specificity and theoretical integration of the concepts underlying the labels, and the function remains the same. It must be remembered that some classes

of behaviors cannot be described by this function as now labeled, since it is now relevant only to situations in which the possibility for some degree of behavioral complexity exists; however, if one conceives of it as the general curve representing the behavior of any one subject in a variety of situations, it is valid.

An elaboration of this function permits us to represent the comparative curves of subjects capable of different degrees of mediational complexity. It is hypothesized that as the mediating conceptual structure of the organism becomes increasingly abstract, the function is affected in three ways: a) optimal structural complexity is reached at a higher level of stimulus complexity; b) the absolute level of information processing complexity is higher at all but the most extreme levels of stimulus complexity; and c) the slope of the curve becomes less steep. Thus, Fig. 2 may represent the appropriate curves for individuals functioning at the four nodal stages described on pp. 24-27.

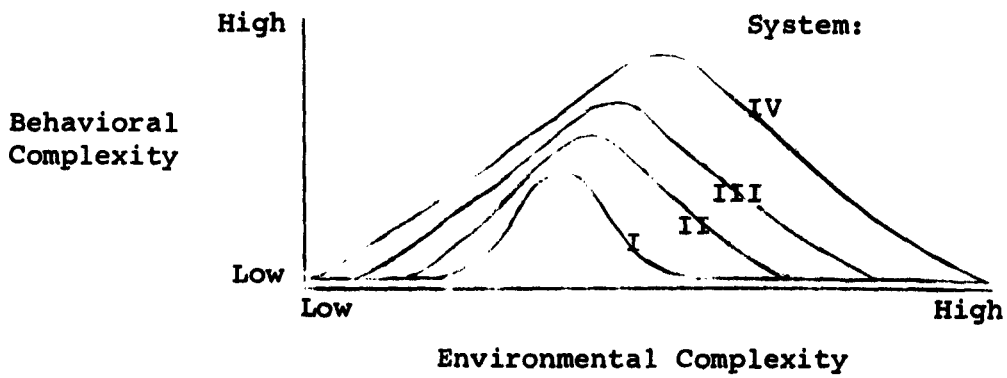

Fig. 2. The relationship between environmental and behavioral complexity for individuals functioning at each of the four nodal levels of conceptual complexity (adapted from Schroder, 1963, p. 14).

A considerable amount of relevant evidence has been collected by researchers specifically basing the selection of subjects and of experimental manipulations on the theory of Schroder and his associates.

In a series of experiments utilizing a war game in which four-man groups were pitted against a programmed "enemy" (Lawrence, 1962; Schroder, et al., 1963), the teams were composed homogeneously of concrete and abstract individuals. It was found that during periods of high informational complexity concrete groups abandoned previously formed long-term plans and based their decisions to a great extent upon environmental anchors (i.e., tended to respond to each action of the enemy in a one-for-one way). The abstract teams generated strategies of greater integrative complexity than did the concretes, and followed them even in periods of high rate of informational input. For both types of teams, the extent of integration of strategies varied with the informational complexity of feedback in accordance with the curves in Fig. 2, concrete groups evidencing a greater degree of structural regression (i.e., a steeper decline) once past the optimal level of situational complexity. In a more recent war-game study (Streufert, 1963), the rate of informational flow was systematically varied from 2 to 40 units of "new" information per half hour. Using such measures of behavioral complexity as number of integrations in a given time period and quality of integrative strategies, Streufert found that the behavioral complexity curves of concrete and abstract groups were in general agreement with the theoretically-derived functions presented in Fig. 2. An information input rate of 10 units per half hour was optimal; beyond that point, behavioral complexity decreased differentially in teams composed homogeneously

in terms of conceptual structure. A modification of the theoretical curve may be suggested by the finding that while both the concrete and the abstract groups behaved more simply when the rate of informational input was minimal or maximal than at moderate rates, the concrete teams were less affected at 2 than at 40 units per half hour, while the reverse was true of the abstract teams.

Driver (1962) found that homogeneous concrete groups utilized fewer dimensions in developing attitudes towards other teams in an inter-nation simulation situation than did abstract groups. Again, the inverted U function held true, in that with relatively low involvement and informational value in the environment the number of dimensions was small; as environmental complexity increased, so did the number of dimensions; but as environmental complexity exceeded an optimal point, first the concrete and then the abstract teams reduced the number of dimensions considered. As predicted in Fig. 2, the curves for the abstract and concrete groups never overlapped.

Using a simulated stock market game, Tuckman (1963) discovered that teams composed of concrete individuals "tracked" fewer aspects of environment, and thus utilized fewer of the informative dimensions available to them, than did teams of abstract subjects. Furthermore, intra-team decision-making processes showed much more diversity in the abstract than in the concrete groups.

Allen (1962) reported that concrete subjects evidenced more extreme (greater or smaller) latency in recognizing aniseikonic distortion than did abstract individuals. This was predicted, since the subject had to resolve informational conflict - the knowledge that a wall is perpendicular vs. the

subject's perception of it as sloping. Concrete subjects, compartmentalizing the use of alternate schemata, quickly closed on either one or the other of these inputs; abstract individuals, who integrate the two units of information, had moderate recognition latencies. Allen then added instructions emphasizing either the distortion-producing effect of the lenses or the constancy and fixedness of the wall, and found that concrete subjects tended to rely on these instructions and either decrease or increase the latency of recognition depending upon the set of instructions presented to them. Abstract subjects, on the other hand, showed less reliance on the external anchors provided by the instructions. When the complexity of the environment was greatly increased by the addition of a delayed auditory feedback task, the structural regression evidenced by concrete subjects - as measured by their susceptibility to the environmental suggestion of the instructions - was also increased.

Goldstein (1963) also used delayed auditory feedback to increase the complexity of environmental input. His findings support the conclusion that the presentation of abnormally complex information is associated with structural regression. All subjects showed decreased behavioral differentiation after sonic confusion, with the effect being particularly great in concrete individuals.

The effects of environmental complexity on interpersonal attitudes were studied by Streufert (1962) and Brooks (1962). Streufert found that as interactive complexity (the amount of communication within a group) increased, negative attitudes towards a source of refutation increased also. In extremely concrete (System I) individuals, this function did not vary with interactive complexity, since refuting sources were com-

pletely rejected under all conditions of interaction; System II concrete individuals did evaluate such sources more negatively when the environment was more complex, while abstract (System III and IV) subjects showed relatively little rejection of the source. Brooks' study indicated that favorableness of attitudes towards other members of a cooperating team increased as a function of environmental complexity up to a point - as informational input continued to rise in complexity past that point, concrete subjects rapidly, and abstract subjects slowly, became unfavorable towards their teammates.

All of these studies have confirmed the hypotheses that a) differentiation and integration of behavior varies as a curvilinear function of the complexity of information provided by the environment, and b) the complexity of the mediating conceptual structure of the individual affects this function differentially and predictably. However, while all four nodal stages of conceptual functioning have been considered, and a wide range of behavioral measures has been taken, the range of environments which has been studied has been somewhat more restricted. The "content" of the environments, ranging from the inter-nation simulation to aniseikonic vision, has indeed been diverse; but most of the manipulations of informational input have been in the direction of greater than optimal complexity. Only in a few cases have situations of relatively low information value been used, and in no study has the environment been greatly impoverished.

The research which is reported in this paper utilizes an extremely restricted environment to evaluate the effects of lack of informational complexity upon behavior. As was mentioned on pp. 7-8 the confinement of adults under sensory deprivation conditions has resulted in numerous behavioral

decrements. Sensory deprivation, if conceived of as the reduction to a relatively low level of the usable information available from external sources, should lead to structural regression which is reflected by reduced differentiation and integration in performance. This effect should be particularly striking in concrete subjects, because of their reliance upon external referents as guidelines for behavior; the reduction of environmental stimulation should not greatly influence abstract subjects who are more able to utilize internally generated information, and for whom sensory deprivation, being a new and unstructured situation, may be a somewhat less disorienting experience (cf., p. 27).

An important problem in sensory deprivation studies is the selection of a performance measure. Most tasks used in the past as indices of the cognitive and affective results of sensory deprivation have necessitated the excessive stimulation of the subject and a disruption of the sensory deprivation situation itself (see the criticism of such procedures in Kubzansky, 1961, and Wheaton, 1959). It was necessary to devise a task which, while permitting differentiation and integration in the response, did not involve undue stimulation either in the stimuli presented or in the required response.

It was decided to use a "propaganda" presentation aimed at producing attitude change. This decision was based upon the consideration that such a presentation could be kept relatively short and of little sensory impact, and yet be designed to permit responses of varying degrees of complexity. Another crucial factor in this decision was the relevance of such a stimulus to an important and interesting problem, consideration of which became a popular issue in the early 1950's and has abated only slightly since then. This issue was the

attitude change produced by Soviet and Chinese Communist indoctrinators in their military and civilian prisoners.

Section I-4. Brainwashing: review of the literature.

After the Korean War, the American public was shocked by widely disseminated reports concerning the behavior of United Nations - and particularly United States - troops who had been captured by the Chinese Communists. Not a single such prisoner of war had escaped from the permanent prison camps; individuals of all ranks had collaborated with the enemy, even to the extent of denouncing their country, their service, and their fellow prisoners; 21 Americans and one Briton had refused repatriation and chosen to remain in Communist China after the war. Denunciation and courts-martial, a new, stringent military Code of Conduct, investigating committees both military and civilian, helped to spread the feeling that something truly unprecedented had occurred. Never before had an enemy managed to so subvert American soldiers (Kinkead, 1959).

As inquiries continued, it was reported that the success of the Chinese hinged upon a scientific technique for predictably and reliably bringing about fundamental changes in ideology and personality - a technique which was given a label redolent of mystery and power: "brainwashing." Brainwashing, also referred to as thought reform, coercive persuasion, and menticide, was the method by which experienced career officers - not merely young draftees - could be forced to confess that the United States had used biological agents against innocent Korean famers (Meerloo, 1956), that South Korea, with the instigation and help of the United States, had invaded peaceful North Korea (Chinese People's Committee

for World Peace, 1953), that it was indeed evil for America to have interfered in the private affairs of the Chinese and Korean People's Republics (Condron, Corden, and Sullivan, 1955).

These reports were strongly reminiscent of the confessions of Russian Bolshevik leaders during the Moscow Trials of the 1930's. There, too, individuals of high position and ability had disappeared for a period of time, to re-emerge completely changed: confessing to crimes that they could not possibly have committed, implicating erstwhile friends, condemning themselves as traitors deserving death. It was logical that the two series of events - the"breaking" of American prisoners by the Chinese and of the "old Bolsheviks" by the OGPU - should be connected in the public mind.

Naturally enough, the Western scientific community became deeply involved in the study and explication of the brainwashing technique. Psychologists and psychiatrists gathered data from repatriated prisoners of war (e.g., Schein, 1956, 1957; Segal, 1957), from American and European civilians who had been living in China, arrested by the Communists, imprisoned for varying lengths of time, and finally released (Schein, 1961 a, b; Lifton, 1961), and from Chinese nationals who had fled to Hong Kong (Schein, 1961b; Lifton, 1957, 1961).

The findings failed to support the view that the Communists had developed an unfailingly effective system for producing attitude change. The showcase trials of the 1930's, while involving spectacular recantations by approximately 50 Soviet leaders and their supposed confederates, left unmentioned an indeterminate number of anti-Stalin oppositionists who were arrested by the secret police and then permanently disappeared (Thomas and Seidman, 1939). It may be conjectured that many of these were individuals who could not be influenced to the

point that they could safely be exhibited at a public trial ("For every one of the fifty-four prisoners who figured in the three 'treason trials,' at least one hundred were shot without being broken down." Krivitsky, 1939, p. 191). Furthermore, some instances of resistance did occur even among those defendants who were tried in public (Leites and Bernaut, 1954). The results of thought reform among the Chinese population cannot be established with exactness, since the overwhelming majority of those who experienced it remain in China; but the very fact that numerous students at the "revolutionary colleges," which are institutions for ideological indoctrination, have defected to the West indicates that brainwashing is not infallible (Lifton, 1961). Westerners residing in China frequently denounced the Communists vehemently after being released and reaching safety (Schein, 1961a). The proportion of collaborators among American POW's, finally computed at approximately 15% (Segal, 1957), and the many cases of often heroic resistance (Hunter, 1956; Pate, 1955), point to limits to the efficacy of the procedure used by their Chinese captors.

On the other hand, case studies of some individuals who had undergone the brainwashing technique indicate that long-range, sincere attitude change - as indicated by Westerners who, even long after their release, continued to support the Communist viewpoint and to condemn their own pre-imprisonment activities and beliefs - did take place in some instances (Schein, 1961a). The behavior of some prisoners of war, who wrote elaborate articles in praise of the Chinese "People's Volunteers" and in condemnation of the United Nations forces (Chinese People's Committee for World Peace, 1953; Condron et al., 1955; Burchett, 1953; Mayer, 1957), and some of whom - including decorated veterans of World War II- climaxed their

collaboration by refusing to return to America after the end of hostilities (Pasley, 1955), is further evidence that the thought reform technique is a potent, even if not an omnipotent one.

Most of the victims who experienced brainwashing in Russia were executed. A relatively few survivors have described their experiences (e.g., Weissberg, 1951), but as these were obscure prisoners, it is possible that their experiences were different from those of the defendants in the show trials. Because of the inaccessibility of the purged Bolshevik leaders and their post-World War II counterparts, such as Rajk (Leites and Bernaut, 1954) most of the analyses of brainwashing to date have placed primary emphasis upon the methods of the Chinese Communists.

A distinction which must be made when considering these studies is that between the processes involved in eliciting behavioral submission and those employed in the attempt to obtain ideological change. Schein (1957b) pointed out that, as far as American POW's were concerned, real attitude change was comparatively rare: "...very few changes...occurred that resembled actual conversion to Communism" (p. 26). Collaboration, on the other hand, was more frequent: 15% of repatriated prisoners were judged to have committed acts which justified court-martial or dishonorable discharge (Segal, 1957). It is understandable that, given the extreme physical suffering of many of these prisoners, some amount of collaboration - to avoid punishment and to obtain rewards of food, clothing, medical treatment, etc. - should take place (according to Schein, 1957b, not significantly more than was observed during World War II among Americans in German and Japanese POW camps). Unfortunately, much confusion has

resulted from the failure of researchers, and to an even greater degree of reporters, to differentiate among relatively short-term and simple collaborative behavior (e.g., being one of the signers of a peace petition), those indicating more extensive behavioral, and a possibility of ideological, compliance (such as delivering a series of public lectures and confessions, leading group discussions condemning Western policies, writing and broadcasting pro-Communist propaganda), and those pointing to definite change in values and attitudes (continued support of the Communist line even after release, refusal to be repatriated). It seems reasonable to use the term "brain-washing" and "thought reform" to denote only that process which is designed to bring about actual conversion, and to exclude the methods (similar to those used in prisons and prison camps everywhere) which were used in POW compounds to gain mere compliance with orders (cf., Schein, 1956).

The technique of brainwashing rests upon the captor's maximal control over the physical and social environment of the prisoner. Most captives are initially in a state of emotional arousal - the shock of being arrested or captured, anxiety concerning future treatment, guilt feelings, etc. It is the brainwasher's duty to make clear that he and his associates are the only ones to whom the prisoner can look for help or sympathy (Schein, 1956). As Lifton points out, "...the most basic feature of the thought reform environment, the psychological current upon which all else depends, is the control of human communication." (1961, p. 420).

The leaders among the prisoner group are immediately removed and segregated, or their authority undermined (Schein, 1960). In order to weaken the ties of the prisoner to his previous in-groups, many devices are used. Among these is the use of

forged confessions or of confessions obtained by trickery from other prisoners, to prove that "everybody collaborates"; the cutting off of all information except that furthering the captors' viewpoint; maximal use of "progressive" prisoners in attempting to elicit similar behavior on the part of their recalcitrant fellows (with the added advantage that it makes the "progressives" even more alienated from their fellow prisoners); falsely naming some men as informants and collaborators (Schein, 1960). In civilian prisons and "revolutionary colleges," the "struggle" and self-criticism meetings, in which fellow prisoners or students (i.e., members of the in-group) who were further along in reforming themselves (Schein, 1961b) took highly active roles in putting constant pressure on the "criminal" to confess his guilt and to cooperate with the captors were of primary importance (Schein, 1960; 1961a, b; Lifton, 1957, 1961).

Another technique which is often mentioned is the use of isolation. While solitary confinement is most frequently described as a method of Russian and East European police organizations, it was also often employed by the Chinese Communists, especially in the handling of important prisoners (Hinkle and Wolff, 1956). Lifton says: "Some prisoners are held in isolation for a few weeks....they experience particularly disturbing feelings of loneliness, hopelessness, and abandonment; their interrogators become their only form of direct communication with others" (1961, pp. 486-487). In some cases, prisoners have been confined in solitary cells for more than two years (Schein, 1960). Weissberg, imprisoned by the Soviet secret police, reports: "Gradually the loneliness closed in....later I was to experience situations which amounted almost to physical torture, but even that seemed

preferable to absolute isolation" (1951, p. 89). Krivitsky, a former Soviet intelligence officer, says: "...the Cheka [secret police] erected a specialprison for important political prisoners. Most of them are kept in solitary confinement, and the prison itself is now called the 'Isolator'" (1939, p. 199). Although to some prisoners isolation was less threatening than close and continued contact with their "reformed" fellows (Schein, 1960), the use of solitary confinement was very effective in most cases insofar as it removed social contacts and supports from the environment and left the interrogator or indoctrinator as the sole interacting human being in the prisoner's life (Leites and Bernaut, 1954; Meerloo, 1956; etc.). The similarity between this role and that of the experimenter in sensory deprivation should be noted (cf., Azima, Vispo, and Azima, 1961).

Schein (1961a) describes in detail some of the other techniques, apparently the very opposite of solitary confinement, which were used in Chinese prisons to "unfreeze" the prisoner - that is, to weaken his existing attitude structure and prepare him for attitudinal change. Among these, he notes the use of manacles to make the prisoner completely dependent upon his cellmates for even the most basic physical needs; absolute lack of privacy; constant scrutiny by guards and by cellmates; incessant questioning, criticism, and accusation, coupled with physical punishment, originating both with the indoctrinator and with cellmates; lack of sleep because of the continuous presentation of propaganda and arguments. All of these techniques keep the prisoner in a constant state of cognitive, emotional, and physical arousal, and apparently often succeed in producing disorientation and increased susceptibility to indoctrination. A less extreme but similar process,

using physical stress in the form of extremely hard labor and little food, combined with a storm of denunciations, forced self-criticism, and "struggle" sessions, is apparently in use in the "revolutionary colleges" (Lifton, 1961).

One of the most favored theoretical analyses of brainwashing is based upon classical and/or instrumental conditioning (Meerloo, 1956; Santucci and Winokur, 1955; Hunter, 1956; Sargant, 1957; Farber, Harlow and West, 1957). Generally, the explanation here relates to the arousal of aversive drive states (anxiety, guilt) by the prison situation and by the occurrence of a single collaborative act; these drive states are then reduced by a cognitive reorganization which enables the individual to accept his condition as not only well deserved ("I am guilty") but also as holding forth hope ("But I repent, am atoning, and will be forgiven"), and to look upon his own collaborative behavior as being motivated by a sincere desire to help "the people" - not by fear of the captors. This new belief system is further reinforced by extrinsic rewards, such as better treatment; eventually the learned responses are generalized to a large range of situations. The apparent caprice of the Chinese in allocating rewards and punishments can be interpreted as providing intermittent reinforcement, thus making the response more resistant to extinction. A simpler version of the same type of explanation, the "carrot-and-stick" formula, although advanced as a theory of brainwashing, seems to be more appropriate in explaining behavioral compliance (Schein, 1961a). These views are closely related to that of Doob (1947), who analyzes attitude change in general as adaptive behavior whose goal is to obtain extrinsic rewards.

A second major theoretical orientation which has been

related to brainwashing is the psychoanalytic (Moloney, 1955; Meerloo, 1956; Lifton, 1956, 1957, 1961). Again, the arousal of guilt and anxiety in the prisoner is important: these emotions weaken the ego's autonomy, and in conjunction with the dependence of the victim upon his "struggle" mates and indoctrinators, lead to the occurrence of regression. The individual aften accepts the indoctrinator as the representative of his own superego, identifies with him, and permits the channeling of guilt feelings in such a way that they become attached to his own past actions and beliefs. Submission is rewarding in that it permits more complete identification with the indoctrinator, and in that the act of confession or self-criticism is cathartic.

Socio-psychological identity theories (Lifton, 1961; Biderman, 1960; Leites and Bernaut, 1954) characterize the brainwashing technique as one by which the prisoner's self-concept (loyal Communist leader, respectable businessman, benevolent missionary) is undermined and replaced by the roles ascribed to him by his interrogator or his "struggle" mates: treacherous conspirator, exploiter of the poor, imperialist agent. The denial of the self-concept motivates the individual to seek a new identity, one more consonant with the views which his "significant others" hold of him (Schein, 1961a). Adorno, Frenkel-Brunswick, Levinson, and Sanford (1950) take this view of attitudinal development generally -that is, the primary function of such development is to preserve the individual's self-image and self-integrity.

The cognitive theory of brainwashing proposed by Schein (1961a) emphasizes the information-seeking behavior of the individual who is trying to find an adaptive pattern of behavior in his new environment. If the information flow is

controlled and monopolized by his captors, a cognitive reorganization eventually takes place and the individual begins to understand and eventually to accept the apparently unanimous viewpoint expressed by all of the communications to which he has access. This new frame of reference, or portions of it, may then be retained and used to evaluate behavior, both one's own and others', "producing judgments and evaluations which appear to others to represent dramatic shifts in belief and attitude which cannot be understood" (p. 240). Schein's formulation in regard to brainwashing is highly compatible with the theoretical standpoint of Asch (1948) that attitude change is the result of cognitive reorganization and the shifting of the frame of reference.

Balance theories of attitude change are applicable to the brainwashing situation, but leave unexplained some of the distinguishing characteristics of this method. For example, cognitive dissonance theory (Festinger, 1957) would predict that an act (collaboration) which is at odds with one's belief system (anti-Communism) leads to high dissonance; to reduce dissonance, the private opinion may be brought into line with the overt behavior. The fact that all members must not only be present at but also must actively contribute to propaganda and "struggle" meetings may be interpreted as a realization of the value of even insincere public commitment (cf., Festinger, 1957). As Schein (1961a) points out, the dissonance explanation leaves something to be desired in that it assumes some initial act of collaboration. It leaves the motivation for this act obscure - if it is to be interpreted as being elicited by physical and/or psychological stress (Hinkle and Wolff, 1956; Sargant, 1957; Hunter, 1956), the prisoner has an "out": behavior which is at variance with private opinion is not cognitively dissonant if it can be

rationalized as the result of irresistible external pressure. The congruity model of Osgood and Suci (1955) and the balance models of Heider (1946), Newcomb (1953), Cartwright and Harary (1956), and Abelson and Rosenberg (1958) are likewise appropriate in explaining brainwashing after some initial change has occurred. That is, as long as both the Communist indoctrinators and Communism have negative valences for the prisoner (or the Stalinist interrogator and Stalinism, for the "old Bolsheviks"), and the indoctrinator espouses Communist doctrines, the relations are balanced. It is only when the prisoner begins to have favorable feelings towards, or to identify with, the indoctrinator, or when through cognitive reorganization he begins to accept a "new semantics" (Schein, 1961a, p. 239), in which key concepts such as democracy, freedom, and crime take on the meanings given to them by the Communists, that imbalance or incongruity leads to conversion as a re-balancing technique. Although it is possible to conceive of the beginning of the process as a series of increasingly severe incongruities and ever more drastic re-balancing behaviors, such analyses ignore the environmental peculiarities of the brainwashing situation. These, however, are the very characteristics which distinguish thought reform from mere attitude change: total dependence upon the indoctrinator, completely controlled informational input, uncertainty about the significant aspects of the environment and about the most adaptive behavioral patterns relevant to the environment.

A structural consideration of the two major procedures used in brainwashing makes clear the relevance of the type of theory proposed by Schroder and his co-workers. At one end of the environmental complexity continuum stands the method most favored by the Chinese Communists, in which the captive

is subjected to constant and intense stimulation, almost equivalent to sensory bombardment. In contradistinction there is the system of the Russian secret police - reduction of external stimulation to a minimal practicable level, broken at great intervals by presentation of persuasive material by the interrogator. In either of these situations, the theory would predict a simplification of differentiation and integration of output; this may take the form of complete submission and change in the desired direction, as in those individuals who were successfully brainwashed; or, on the contrary, the closing of the conceptual system, the warding off of incoming information, and the rigid re-affirmation of one's own usual attitudes. This was observed in the militant "reactionaries" of the POW camps and in the civilians who, after being released from Communist prisons, were determined to devote the rest of their lives to combating Communism (e.g, Schein, 1961a). In fact, this "closed-mindedness" has been advocated as the best defense against being brainwashed (Hunter, 1956). Again, the contents of the two responses, and the absolute amount and rate of environmental stimulation, are diametrically opposed; but the structural identity of both the responses and the situations is evident. Individual differences in conceptual structure should be relevant in predicting the response to either of the brainwashing treatments, in accordance with Fig. 2 (p. 32). We would expect concrete individuals to either totally accept or totally reject the propaganda material presented to them, with more abstract persons not closing on either of these responses until situational stress becomes relatively greater.

Section I-5. Brainwashing: Experimental analogues, and the present study.

While some experimental work has been reported concerning the response of individuals in restricted environments to persuasive communications, there has been no consideration of personality differences in this context, nor an attempt to present material lending itself easily to various degrees of complexity in the response. Furthermore, the small number of studies reported does not by any means definitely establish the effects of sensory deprivation on susceptibility to persuasion, in spite of the fact that the technique originated in an attempt to duplicate some of the conditions of the brainwashing situation (Hebb, 1961). A few reports have agreed that individuals undergoing social isolation and/or sensory deprivation show more suggestibility on such tests as body sway and arm levitation (Jones and Goodson, 1959) and perception of autokinetic movement (Walters and Quinn, 1960), although even here the evidence is not consistent (Vernon and Hoffman, 1956). While such measures of suggestibility may be relevant to attitude change (Linton, 1955), more direct tests seem to be preferable.

The work of Bexton (1953) was the first concerning attitudinal suggestibility in subjects undergoing sensory deprivation. He found that after being confined, subjects requested to hear records which were uniformly judged to be unpleasant by most unconfined individuals. Of the group which was allowed to hear the records prior to entering confinement, half (two of four subjects) did not ask to hear the records even once during the experimental session (although subjects who first heard the material while they were confined usually asked to have it repeated). Apparently, the negative set

induced when the subjects first heard the records overcame the desire for stimulation which motivated the other subjects to request repetition. In the other half of this group, and in most of the members of the other group (the one which did not hear the records before confinement), the stimulus value of the material was apparently stronger than its unpleasantness. This of course may not represent attitude change - it is quite consonant with adaptation level, as well as with structure theory: in an impoverished environment even unpleasant information may be better than none.

A second experiment reported by Bexton (1953) was more to the point. Here, subjects were allowed to listen to material arguing for the existence poltergeists, telekinesis, and other psi phenomena. While the subjects were not selected on the basis of their original attitudes, a pilot study had established that the undergraduate body from which subjects were to be drawn disbelieved in parapsychology. Both the confined experimental group and an unconfined control group were permitted to hear the material as often as desired, with the control group being paid extra for each listening session after the first. Only 2 of the 17 controls, but 9 of the 14 experimental subjects, requested repetition of the material.

Both groups were found to have changed their attitudes significantly in the direction advocated by the presentation; however, the difference was considerably greater for the experimental than for the control group. The experimental subjects also evaluated the subject of parapsychology and the material which had been presented to them as more important, more interesting, etc., than did the control group.

In an attempt to change the self-concept of psychiatric patients, Gibby and Adams (1961) confined their subjects in

darkness and silence for 4 hours and then presented them with a 14-minute taped passage suggesting that they were more likeable and worthwhile than they themselves believed. Scores on 20 traits changed in the positive direction for these subjects on all four of the following scales: how they thought they actually were; how high they could realistically be rated; how low they could realistically be rated; and how they thought they would be rated by their peer group. These changes were significantly greater than those evidenced by an untreated control group, a group which heard the tape but was not confined, and a group which was confined but did not hear the tape.

The most elaborate inquiry into the effects of the sensory deprivation situation on susceptibility to propaganda was carried out in 1959 and 1960 by Myers and his co-workers, and will be referred to hereafter as the HumRRO study. The bulk of this work is unpublished, only a description of the procedure and the results of a pilot study being available for reference (Murphy and Hampton, 1962); the majority of the information in this review of the work comes from a summary of preliminary data analysis given by Myers.[1]

Several improvements in design are obvious in comparing the HumRRO study with some of the experiments described previously. One very important innovation was the selection of subjects on the basis of initial attitude scales, and the development of two persuasive passages dealing with the same topic (Turkey and the Turks) in similar ways but leading to opposite conclusions. Both presentations were designed to affect the subject's evaluation of Turkey along the good-bad dimension of a semantic differential measure (Osgood, Suci,

and Tannenbaum, 1957), but one presented "good" and the other "bad" information. The favorable passage was presented to an initially pro-Turk group, and resulted in almost identical amounts of change in the desired directions as measured on the semantic differential (Murphy and Hampton, 1962). There was no significant attitude change in a control group which was confined but heard no tape. Besides the equipotency of the two presentations, they have other advantages: there is no mention of the source of the material, the presentation is only three minutes long (so that the duration of sensory stimulation is relatively limited), and the concentration on one attitudinal dimension makes it possible to measure the change caused by the presentation simply and rapidly.

The results of the major experiment (as opposed to the pilot study cited above) were inconclusive. Confined subjects requested to hear the tape more frequently than did controls, and evaluated both the material and its presentation (e.g, the voice of the individual reading the passage) more favorably; there was, however, no significant attitude change in the direction of the propaganda. Thus, in spite of the careful selection of subjects and the design of the propaganda material, the attitude change findings of Bexton (1953) and of Gibby and Adams (1961) were not corroborated.

There are several reasons which may be responsible for this failure to replicate previous results. One obvious one is the inclusion of subjects with fairly extreme initial attitudes which were opposed to the direction of the persuasive communication. The material and the situational manipulation may just not be potent enough to overcome such strong initial opposition. Another source of resistance may have been a knowledge on the part of the subject that there was an attempt

made at manipulating attitudes, possibly cued by the extremity of some of the statements in the presentation. A third is the free mobility of the subjects within their chambers and the repeated presentation of the material upon request, which may have mitigated the severity of the deprivation state.

In the study on which the present paper is based, an attempt was made to eliminate these factors. Subjects were selected for neutrality of original attitude; the experiment was forcefully characterized as being concerned with learning, and the more extreme statements in the HumRRO presentation eliminated; mobility in the sensory deprivation chamber was minimized; and the propaganda was presented only once.

The pro- and anti-Turk presentations were combined, with a small portion of the negative communication being excluded. A strong pro-Turk argument was followed by a slightly weaker anti-Turk argument; thus, subjects could either integrate the two, with a resultant lack of attitude change (or at most a slight degree of pro-Turk change), or could schematize the information in such a way that either one side or the other would be completely accepted. It was hypothesized that the latter reaction would be characteristic of concrete subjects; and since these individuals were predicted to be stressed by the lack of external referents during sensory deprivation, it was expected that they would unreservedly accept the first (i.e., the pro-Turk) referents presented. Unconfined control groups were expected to show no structural regression; conceptual system-linked differences similar to those of the confined groups were predicted, but the differences among groups were expected to be much smaller and the absolute amount of attitude change generally less than was predicted for sensorially deprived subjects. Thus, the hypotheses concerning attitude change were:

a) Sensorially deprived individuals in general will change in the pro-Turkish direction more than control subjects.

b) Within the sensory deprivation group, concrete subjects will change the most, with less if any change on the part of abstract subjects.

c) Within the control group, there will be no change in the abstract, and limited change in the control, subjects.

Secondary hypotheses were derived concerning recall and evaluation of the persuasive material:

d) Because of differential attention, confined subjects will recall the passage better than controls; for the same reason, concrete confined subjects will have better recall than abstracts.

e) Sensory deprivation subjects will evaluate the material more favorably than controls, with concrete confined subjects being the most favorable. There will be little or no difference between abstract and concrete subjects in the control condition.

II. METHOD

Section II-1. Subjects.

Of 334 Rutgers University undergraduates who volunteered to undergo 24 hrs. of sensory deprivation, 60 Ss were chosen by the method described below.

Section II-2. Selection.

Subjects were selected on the basis of their scores on the following tests:

a) Turk attitude scale.

The initial attitude scale was the one used in the HumRRO study. It consisted of 19 stems (concepts), each with nine bipolar semantic differential scales (three representing the evaluative, three the activity, and three the potency dimension). Some stems were of high face validity for sensory deprivation volunteers (e.g., "isolation," "darkness"). "Turks" was one of four stems which identified national groups. Since the propaganda material was concerned with the evaluative factor, only the three scales relevant to this factor (good-bad, pleasant-unpleasant, clean-dirty; see Osgood, Suci, and Tannenbaum, 1957, and Murphy and Hampton, 1962) were considered in the selection of Ss. Scores on each scale can range from a minimum of 1 (in this case, extremely favorable) to a maximum of 7 (extremely unfavorable). Thus, the minimum total score for the three scales was 3, and the maximum score was 21, with lower scores indicating pro-Turk attitudes. Subjects were accepted if their scores fell into the neutral range (9-15). Of the 334 volunteers, 240 were qualified on this basis. In this way, it was made certain

that individuals with extreme pre-experimental attitudes towards the Turks were eliminated, and that the relevant attitudes of the final subject group were homogeneously neutral.

Reliability and validity measures for the semantic differential are presented by Osgood et al., (1957, esp. Ch. 4). Test-retest reliability was highest for scales concerning the evaluative factor, with only 6.2% of subjects averaging a change of as much as 1 scale unit from the first to the second administration. Reliability coefficients obtained by repeated presentation of rating scales measuring attitudes towards such concepts as capital punishment, the church, etc., have typically been in the .80's and .90's. Validity, in terms of prediction of both experimental responses and real-life behavior, has been shown to be consistently high.

b) Impression formation test.

This instrument, originated by Asch (1952), has been used in several studies of conceptual structure. A scoring manual (Streufert and Schroder, 1962) specifies criteria for inferring the degree of differentiation and integration of information processing from the way in which the subject combines two sets of somewhat incongruous adjectives in the description of a hypothetical person. Inter-judge reliabilities for this test have typically been in the .80's. The average correlation between scores on two forms of the test is .53; although this is, of course, an indication of relatively low reliability, it must be noted that practice can greatly affect future responses onthis test, making two successive administrations subjectively quite different (Streufert and Schroder, 1962).

c) Sentence completion test.

This test presents the subject with stems (words and phrases) which he is to use in writing several sentences. These stems concern the areas of interpersonal relationships, attitudes towards externally imposed authority, and reactions to situations involving uncertainty and the possibility of alternative decisions. Completions can be scored in terms of the complexity of conceptual structures which give rise to them. In the past, split-half reliabilities of approximately .65 have been obtained, with inter-judge scoring reliability with trained scorers averaging .85-.95. Again, the reliability coefficient is spuriously low, since the halves of the test are not really equivalent: some of the content areas are sampled by odd numbers of stems, and thus are not equally represented in the two halves (Schroder and Streufert, 1962).

In this experiment, a revised scoring system was used, in which each completion was graded from 0 to a maximum of 3 for the presence of System I, II, III, and IV referents (see Schroder and Streufert, 1962; Schroder, Driver, and Streufert, 1963). The total score for each system was then computed and divided by the number of scoreable completions, giving a profile which showed the relative salience of referents for each system. In order to be selected for the experiment, a protocol had to show an average score of at least 2.0 (of a possible 3.0) on the strongest system, with no other system scoring above 1.0, the total of the three other systems not exceeding 2.0, and not more than one unscoreable completion. All of the protocols were scored independently by at least two, and in most cases three, trained scorers. No subject was accepted unless at least two scorers agreed that his completions met the criteria described above. When any

disagreement existed between judges, the impression formation test was scored and the decision regarding acceptance was based upon its agreement or disagreement with the sentence completion ratings. It is to be noted that this procedure was ipsative, rather than normative as had been the case with the selection methods used in some previous studies (e.g., Goldstein, 1963), and resulted in the selection of fairly pure groups of subjects. One disadvantage was the small proportion of subjects who met the criteria (see Section II-3).

It is difficult to specify the validity of the sentence completion and the impression formation methods. The two tests correlate with each other in the .90's, and therefore may be assumed to be measuring the same response characteristics. Their correlations with other tests which measure qualities related to abstractness-concreteness (e.g., authoritarianism, dogmatism, rigidity) have been in the expected directions, and the behavior of experimental subjects selected on the basis of their scores on the two tests have been generally compatible with theoretically-derived predictions.

A number of other tests were also administered, as secondary selection instruments, but did not have to be used since the primary tests succeeded in indentifying an acceptable number of clearly classified subjects. Subjects who on an autobiographical questionnaire indicated travel in or near Turkey were eliminated. The secondary instruments and the autobiographical questionnaire proved to be useful in reducing the salience of the critical tests and items, and were also referred to in answer to inquiries concerning the basis of acceptance or rejection of volunteers. It was decided to obtain intelligence measures for our subjects, although such measures were not used in selecting subjects nor in assigning

them to groups. One reason for this decision was the correlation which has previously been found between abstractness of conceptual functioning and intelligence (see Schroder and Streufert, 1962), and which apparently diminishes as more highly educated groups are used as sources of the subjects. Furthermore, Myers[1] has indicated that relatively high-intelligence subjects behaved differently from individuals lower in intelligence in the HumRRO study (see Section IV). The only measure of intelligence on which scores were available for every subject was the scholastic aptitude part of the CEEB, and these scores were secured from the records of Rutgers University.

Section II-3. Procedure.

On the basis of the selection procedure, approximately 25 Ss were classified as functioning at the System I, II, or III level of conceptual complexity. The number of System IV protocols was insufficient for such a group to be included without lowering the selection criteria, and it was decided to use three groups: Concrete (System I), Intermediate (System II, functioning at a concrete level but not as extremely concrete as System I), and Abstract (System III, in the absence of the extremely abstract System IV subjects). Of the 25 Ss in each group, 10 were randomly selected for the sensory deprivation treatment and 10 for the control treatment, while the rest were held in reserve to replace Ss who failed to keep appointments or requested early release.

The two treatments were as follows:

Sensory deprivation (SD): These Ss were confined in one of the isolation chambers of the Princeton Sensory Deprivation Laboratory (for complete description of the physical and

acoustical characteristics of the chambers, see Suedfeld et al., 1963). The two chambers, which were used in random order, were completely dark and relatively soundproof. They were furnished with a bed, a food box, a urine jar, and a chemical toilet. A urinator strapped to the body enabled Ss to urinate without getting off the bed. Water and bland liquid dietetic food were available to the S through plastic tubes which extended from the food box to his pillow, and which he could reach by merely turning his head. Each chamber was equipped with a release switch, to be used to signal that the S wanted to terminate the experiment. Subjects were also shown how to release themselves from the chamber if the signal was not answered within five minutes. No S was permitted to see the chamber nor to explore in the dark any part of the chamber besides the bed, food tubes, chemical toilet, release switch, and the route from the bed to the door.

Non-confined (NC): NC Ss were told that they were to remain in Princeton for 24 hrs. They were requested not to communicate with anyone outside the town during that time, and to spend most of the 24 hrs. in the main reading rooms of Firestone Library. However, they were given permission to walk around the campus for a short period of time and to attend a movie. They were required to spend 12 hrs. (9 P.M. - 9 A.M.) in the laboratory in Eno Hall, and were not permitted to leave Eno Basement during this time. A bed was available in the monitoring room of the laboratory, and Ss were shown how to release SD Ss if the release signal were set off during the night. At 9 A.M. these Ss were sent for breakfast and to the Library, to return at 2 P.M. for final testing.[2]

Scheduling was arranged in such a way that one NC and

at least one SD subject were run simultaneously. In the few instances where two NC subjects had to be run in one day, their briefing times were staggered and their sleeping places were separated in order to minimize the occurrence of interaction between them. Subjects reported to the laboratory at 3 P.M. and were released between 1 and 2 P.M. the following day.

When Ss reported to the laboratory, they were asked to fill out certain administrative forms indicating that the research in which they were to participate was sponsored by the United States Government. It was then explained to them that this was an experiment concerning the effects of an unusual environment on learning, and that a few hours prior to the end of the experimental session they would hear a tape recorded passage. They were to try to memorize this passage; but they were warned that it was a long one, and that if they could not remember the exact wording and order they should concentrate upon and remember the ideas which were presented. After the passage was over, they would be asked a few questions over the intercom system, and then they would be instructed to repeat back whatever they remembered of the passage. The silence condition would then be re-established, until at the end of 24 hrs. a few further tests would be administered and they would be released.

The Ss were instructed to defecate prior to entering the chamber, and it was emphasized that they were forbidden to sit up on, or leave, the bed, as well as to make unnecessary movements or noise of any sort except in accordance with instructions. They were warned that they were to be monitored intermittently and released without payment if

found to be violating these rules. No instance of such violation was noted by auditory monitoring, and only one SD subject had to defecate during confinement.

SD subjects were then blindfolded and taken into their chamber. They were taught the location and use of the food and water tubes, urinator, chemical toilet, and release switch, and were rehearsed in the self-release routine. They were then returned to the bed; E repeated to them the instructions concerning movement and noise, and reminded them about the passage which they would hear and their task in relation to it. E then left the chamber.

After the confinement of the SD subject(s), the NC subject was informed that the "unusual environment" which he was to experience was to remain in an unfamiliar locality for 24 hours (it was ascertained that Princeton University and the town of Princeton were strange to all of our Ss). He was then given the rules outlined on p. 61, and told that his presence would be checked both in the library during the day and in the laboratory during the night. He was told that the passage and the recall test would be administered to him upon his return to the laboratory after lunch the next day.

At between 1 and 2 P.M. the following day (before the return of the NC subject), the propaganda passage was played to the SD subjects. At the time, Ss were still confined to bed in the darkened chambers. After the end of the tape, they were presented with an auditory form of the Turk attitude scale (the "Turks" stem only), and then were asked to repeat back the passage as well as they remembered it. When they had completed this task, E entered the room and

put on the light. Subjects were given an ad hoc scale designed to measure their evaluation of the passage. They were then asked to dress, clean their urine jar, and make the bed in the chamber prior to being dismissed.

When NC subjects returned to the laboratory, they were taken into the darkened chamber and told to lie on the bed until E returned. The passage and tests were then administered as they had been to the SD group, and the subjects were released.

The importance of secrecy in preventing contamination of future findings was strongly emphasized to all Ss. While there is, of course, no absolute way to test their cooperation in this matter, questioning of every S showed that none had been told anything about the content of the passage, and that none was aware that some Ss did not receive the SD treatment.

Briefly, the combination of treatments and conceptual level groups was as shown in Figure 3, with group designations entered in the cells. Each cell represents ten subjects.

		TREATMENTS	
		Sensory deprivation	Non-confinement
CONCEPTUAL COMPLEXITY	Concrete (System I)	SD-C	NC-C
	Intermediate (System II)	SD-I	NC-I
	Abstract (System III)	SD-A	NC-A

Fig. 3. Experimental design.

It should be emphasized that the "Abstract" group was composed of somewhat, but not extremely, abstract subjects, and may be properly conceived of as the abstract counterpart of the intermediate rather than of the extremely concrete group.

III. RESULTS

Section III-1. Attitude change.

In considering the attitude and attitude change scores presented in Tables 1-5, the following characteristics of the semantic differential measure should be remembered:

a) A score of 12 represents absolute neutrality (an average of 4 - neutral - on each of the three bipolar scales).

b) Scores higher than 12 indicate anti-Turkish evaluations, and scores lower than 12 signify pro-Turkish ratings.

c) Change in the direction of the pro-Turk propaganda presentation (i.e., change in the expected direction) is represented by higher initial than final scores; in Tables 2, 3, and 5, positive scores indicate such changes while negative scores indicate a boomerang effect.

Table 1 shows the mean initial and final attitude scores for the three conceptual level groups in each treatment. A two-tailed *t* test (Table 2) shows a highly significant change in the expected direction for the concrete and intermediate SD groups (SD-C and SD-I), and a non-significant change in the predicted direction for the confined abstract group (SD-A). Changes in the non-confined groups were not significant; nor was the negative change (boomerang effect) which was evidenced by the NC-A group. The SD group as a whole showed a highly significant change in the direction of the pro-Turkish communication, while the NC group did not.

Table 1. Mean attitude score.

	SD		NC	
	Initial	Final	Initial	Final
Concrete	12.9	8.7	13.1	11.8
Intermediate	12.1	9.8	12.4	12.0
Abstract	12.3	11.3	12.1	12.8

Table 2. Mean attitude change.

	SD			NC		
	$\bar{M}$ change	t	Signif.	$\bar{M}$ change	t	Signif.
Concrete	4.2	3.717	$p<.005$	1.3	1.444	$.20>p>.10$
Intermediate	2.3	2.329	$p<.05$	0.4	0.496	$p>.20$
Abstract	1.0	1.572	$.20>p>.10$	-0.7	0.644	$p>.20$
All systems	2.5	4.167	$p<.0005$	0.3	0.536	$p>.20$

Tables 3 and 4 present a two-way analysis of variance for the mean changes across conceptual levels and across treatments. Both main effects were significant; the interaction effect was not.

Table 3. Mean attitude change.

	SD	NC	System mean
Concrete	4.2	1.3	2.75
Intermediate	2.3	0.4	1.35
Abstract	1.0	-0.7	0.15
Treatment mean	2.50	0.33	

Table 4. Analysis of variance for Table 3.

Source	df	ss	ms	F	Signif.
Systems (R)	2	67.73	33.87	3.611	$p < .05$
Treatments (C)	1	70.42	70.42	7.508	$p < .01$
Interaction(RC)	2	4.13	2.07	<1	NS
Within cells(w)	54	506.30	9.38		
Total	59	648.58			

The two polar groups within each treatment are compared (SD-C *vs.* SD-A, and NC-C *vs.* NC-A) in Table 5. The difference between the mean attitude changes of these groups was significant for the SD, but not the NC, treatment (two-tailed *t* test).

Table 5. Differential attitude change in abstract and concrete subjects.

	$\bar{M}$ difference	t	Signif.
SD	3.2	2.481	$p < .05$
NC	2.0	1.379	$p > .20$

Section III-2. Recall.

The propaganda passage was subdivided into a total of 72 idea units (most of them consisting of one sentence or phrase), and the appearance of the central idea of the unit in the recall tape was scored. Mean recall scores are shown in Table 6, and Table 7 presents an analysis of variance for these data. Neither the main effects nor the interaction was significant.

Table 6. Mean recall.

	SD	NC	System mean
Concrete	42.70	39.00	40.85
Intermediate	46.70	45.30	46.00
Abstract	38.20	42.40	40.30
Treatment mean	42.53	42.23	

Table 7. Analysis of variance for Table 6.

Source	df	ss	ms	F	Signif.
Systems (R)	2	395.43	197.72	1.072	NS
Treatments (C)	1	1.35	1.35	<1	NS
Interaction(RC)	2	165.10	82.55	<1	NS
Within cells(w)	54	9961.30	184.47		
Total	59	10523.18			

Section III-3. Evaluation.

Evaluation of the propaganda presentation is presented and analyzed in Tables 8 and 9. Each positive adjective which the subject checked as applying to the passage was scored +1; each negative adjective checked was scored -1. Although the conceptual level and interaction effects were not significant, analysis of variance shows that the SD group as a whole evaluated the passage significantly more favorably than did the NC group.

Table 8. Mean evaluation score.

	SD	NC	System mean
Concrete	5.70	4.95	5.33
Intermediate	6.75	4.65	5.70
Abstract	6.00	4.95	5.48
Treatment mean	6.15	4.85	

Table 9. Analysis of variance for Table 8.

Source	df	ss	ms	F	Signif.
Systems (R)	2	1.43	0.72	< 1	NS
Treatments (C)	1	25.35	25.35	4.519	$p<.05$
Interaction(RC)	2	5.02	2.51	<1	NS
Within cells(w)	54	303.20	5.61		
Total	59	335.00			

Section III-4. Intelligence.

Rank-order correlation between total scholastic aptitude score and abstractness showed a significant relationship (rho =.282, $t=2.22$, $p<.05$). In order to compare the relationship between intelligence and attitude change with that noted by Myers[1] (see Section IV-3), the subjects undergoing each treatment were divided at the median into high- and low-SAT groups, ignoring conceptual structure. Table 10 shows the mean attitude change scores for these groups. Analysis of variance (Table 11) again demonstrates a significant treatments effect; the intelligence level and the interaction effects were not significant.

Table 10. Mean attitude change.

		SD	NC	SAT group mean
INTELLIGENCE (SAT)	Upper half	2.00	0.33	1.16
	Lower half	3.00	0.53	1.76
	Treatment mean	2.50	0.43	

Table 11. Analysis of variance for Table 10.

Source	df	ss	ms	F	Signif.
Intelligence(R)	1	5.40	5.40	<1	NS
Treatments (C)	1	64.07	64.07	6.22	$p<.05$
Interaction (RC)	1	2.39	2.39	<1	NS
Within cells (w)	56	577.07	10.30		
Total	59	648.93			

IV. DISCUSSION

Section IV-1. The elicitation of attitude change.

The attitude data indicate that subjects who had undergone sensory deprivation were more responsive to the persuasive communication than were subjects whose environment was not thus restricted. It seems reasonable to conclude that reduced availability of environmental information was the causative factor in the increased potency of the material.

These findings are compatible with those of Bexton (1953) and Gibby and Adams (1961). However, they are at variance with the results of the HumRRO study cited earlier. Consideration of other work carried out at HumRRO may explain this inconsistency.

Murphy, Smith, and Myers (1963) disguised an attitude change procedure as an experiment in learning. Subjects were presented with two lists in paired-associate form, with one word being the name of a national group (CS) and the other being an adjective or adverb (UCS). Four national groups were used, one always paired with a positively evaluative (good) adjective, one with a negatively evaluative (bad) adjective, and the other two with evaluatively neutral adjectives. Although there was no difference between the sensorially deprived and the control group in retention of the paired associates, a semantic differential measure showed the confined subjects to have changed their attitudes towards the national groups significantly more (positively towards the CS's paired with "good," and negatively towards those

paired with "bad," UCS's).

Myers[1] has advanced a two-factor explanation of attitude change, one factor being the impact of the persuasive message - increased by the sensory deprivation treatment - and the other being resistance to manipulation. In the "conditioning" study, as in the experiment reported in this paper, the latter factor was minimized because of the reduced salience of the manipulative attempt; the HumRRO attitude change study discussed earlier did not have this feature. Although the one-sided presentation used by HumRRO produced more change in subjects whose original positions were far removed from that advocated in the message than in those who were only moderately opposed, the use of neutral subjects with our more balanced persuasive communication seemed advisable (Myers, Murphy, and Smith, 1963; Myers[1]); such subjects probably had less knowledge about the topic, and therefore experienced the impact of the message more fully, than individuals with strong existing attitudes. It is also possible that neutral subjects are somewhat less resistant to the persuasive material.

Section IV-2. Conceptual complexity and attitude change.

As hypothesized, the effect of sensory deprivation was much stronger for concrete individuals, whose conceptual complexity was generally low, than for more abstract persons. In fact, there was no significant attitude change in the SD-A group, while the change in the SD-C group was highly significant. Furthermore, the difference in attitude change found in a comparison between SD-C and SD-A subjects was not

found in the comparison between NC-C and NC-A subjects; that is, in a fairly normal environment, where there was no interference with availability of external stimulation, neither group showed much susceptibility to propaganda. In the impoverished environment, the abstract group retained its immunity to communication pressure; the more concrete persons, however, became suggestible. An interesting sidelight is the similarity between the attitude change measures of the SD-A and the NC-C groups: concrete subjects in the unrestricted environment were approximately as susceptible to propaganda as were abstract individuals who had experienced the treatment which supposedly heightens suggestibility. Thus, if attitude change is interpreted as a measure of information processing complexity, it seems that the effect of decreased stimulation on the abstract subjects was to reduce their level of functioning to that at which concrete individuals normally operate.

An unexpected finding was the pattern of the three NC attitude change means. While the difference between the NC-A and the NC-C groups was in the predicted direction, it was not significant; and there was a reversal between the NC-A and the NC-I groups in terms of absolute amount of change. Why the NC-A subjects showed even a slight boomerang effect is not known; it may be that some of these subjects discerned and reacted against our attempt to manipulate their attitudes. None brought up the point in post-confinement conversation, and it was decided not to query them in order to avoid arousing suspicion if our interpretation was mistaken. The question, therefore, must remain unanswered; the lack of statistical significance of the effect makes this uncertainty more bearable.

The nature of the measuring instrument may be to some extent responsible for the close correspondence among the NC attitude change scores. Having a maximum of only 12 steps (i.e., if a subject with the highest acceptable initial score, 15, had showed maximal compliance and scored the minimum of 3 on the final test - or vice versa, from a minimum acceptable initial score of 9 to a maximum possible final score of 21), the attitude scale cannot be considered a very sensitive index of behavioral complexity. Furthermore, the task itself would seem to imply an artificial ceiling; if one agrees that both acceptance of and reaction against the propaganda - that is, attitude change in either direction - indicates reduced complexity of information processing, as was argued previously, then it is impossible to show more complexity than is indicated by a complete lack of attitude change. Possible differences in the complexity of the operations leading to this response are not measurable. This is also true of the complexity of the cognitive operations leading to attitude change. It would appear quite plausible to argue that moderate attitude change does not imply structural simplicity, but rather an adaptive utilization of environmental information; it is the definition of "moderate" attitude change that makes this hypothesis difficult to test. Finally, it must be remembered that while our System III "abstract" group, while certainly on the abstract side of the complexity continuum, does not occupy the extreme position on this side; a group of System IV subjects might have shown even greater differences when compared to the concrete subjects of the Systems I and II groups. It should be noted that

this holds true for all of the concrete-abstract comparisons made in this study: the inclusion of an extremely abstract group would presumably have increased the differences between the two polar groups.

Figure 4 shows the approximate locations of the SD and NC situations along the environmental complexity dimension of Figure 2. The curves are not generated as extensions of the data obtained in this experiment, but duplicate the general theoretical functions presented in Figure 2. The NC condition is placed on the restrictive side of the optimal points: a subject who spent all of the night in the basement of an otherwise empty building and most of the day in the library may be presumed to have experienced somewhat less than optimal stimulation, even in the case of concrete individuals. The fact that sensory deprivation was not placed at the extreme end of stimulus reduction was dictated by reports of deprived subjects concerning auditory, tactile, kinesthetic, and proprioceptive stimuli. Furthermore, the presentation of the passage provided some stimulation, interacting with emotional and cognitive factors related to the SD experience and to the learning task. The exact placement of the two experimental situations along the abscissa is not empirically based, of course; the representation in Figure 4 is, however, a veridical one on the basis of the theory. The general relationships found in this study, with the exception of the NC-I and NC-A reversal mentioned previously, accurately fit the theoretical curves: the three curves are considerably closer to each other at the NC than at the SD condition; the curve representing the behavior of the concrete subjects shows

less complexity than that of the abstract subjects at every point, and in fact less complexity at the NC condition than does the abstract function at even the SD condition; and the theoretically predicted inverse relationship between the slope of the functions and conceptual complexity was in fact obtained. Thus it is evident that the curves generated on basis of structural theory, which have been shown to accurately represent the relationships between environmental and behavioral complexity in normal and in intensely stimulating conditions, are equally valid for the relationships which hold true in impoverished environments.

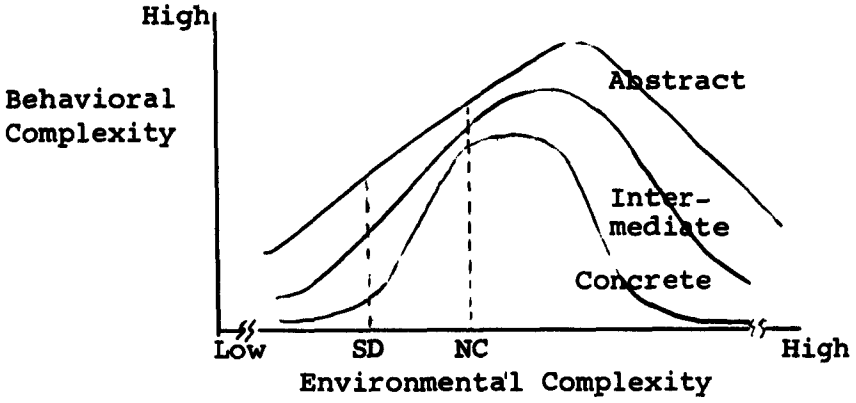

Fig. 4. Environmental complexity in the SD and NC situations.

In interpreting attitude change as a function of conceptual complexity, it must be remembered that other factors may be of great importance depending upon the design of the experiment. It should not be assumed that either susceptibility or resistance to persuasive material can be characterized a priori as complex or simple behavior. However, the persuasive material used in this study was chosen so that a high degree of compliance represented structural regression, since the informational values of the pro- and the anti-Turk presentations were almost equal from an ob-

jective standpoint. Appeals to personality characteristics such as authoritarianism, whose relationship to conceptual structure is uncertain, were avoided; the only potential bias of this sort, ethnocentrism, was controlled by the selection of initially neutral subjects and the prepotency of the pro- rather than the anti-Turk part of the propaganda.

This was one of the few studies to consider the low-complexity environment area of Schroder's curves, and the only one to use so extreme a deprivation condition. It is not, of course, the last word on the question, and much work remains to be done with low-information situations of as widely varying kinds as have been studied on the high-complexity side of the curve. For instance, one wonders about the motivational strength of information for concrete and abstract individuals: it seems possible that while abstract persons are not very much stressed by situations in which information is restricted, they are strongly motivated to obtain information in such situations. Procedures such as those of Jones and his co-workers (Jones, Wilkinson, and Braden, 1961; Jones, 1961; Jones and McGill, 1963) could be used to study this problem.

It would also be interesting to speculate about the connections between structural and arousal/adaptation level theories. According to Harvey, Hunt, and Schroder (1961), training methods which lead to the development of abstract conceptual systems are those which, among other characteristics, reward exploration; it is plausible, therefore, to conjecture that individuals who are reared in this way become accustomed to more diversified stimulation. Thus,

we may hypothesize that abstract individuals have adaptation levels which are higher than those of concrete persons - and, in accordance with the predictions derived from structural theory, a wider range of adaptation. That is, while their optimal level of stimulation is relatively higher, the curve representing behavioral complexity falls off less rapidly on either side of the optimal level than it does for concrete individuals. This explains why abstract individuals can function well at levels of stimulation which are relatively far removed from their optimal, or accustomed, levels - e.g., in sensory deprivation. It is quite possible that the reticular formation is a mediating mechanism in the development of conceptual complexity, in accordance with the formulations of Lindsley (1961): the greater diversity of stimuli encountered by abstract individuals leads to flexibility in the rates and patterns of firing to which the reticular formation is accustomed and which it can handle adaptively, making sensory overload, deprivation, and distortion all relatively tolerable for such individuals.

Section IV-3. Evaluation, recall, and the effects of intelligence.

The findings that SD subjects evaluated the propaganda material more positively than did NC subjects was predicted both on the basis of previous findings in sensory deprivation, concerning the reward value of stimulation *per se* for restricted subjects (Ehrlich, 1961; Lilly, 1956), and on the

basis of theoretical predictions and findings derived from cognitive dissonance formulations - that is, that material which had successfully elicited attitude change would be appraised more favorably (Festinger, 1957). It was further predicted, in accordance with dissonance theory, that concrete SD subjects would evaluate the material more positively than subjects in the SD-I and SD-A groups. This hypothesis was not confirmed, which casts some doubt upon the validity of the dissonance interpretation of the SD-NC difference as contrasted to an explanation in terms of stimulus-action hunger (Lilly, 1956). By extension, this same explanation may be invoked in the acceptance of propaganda by long-confined prisoners (Leites and Bernaut, 1954; Krivitsky, 1939).

Recall of the material was not significantly different either across treatments or across conceptual system groups. The hypothesis that the SD and concrete subjects would outperform the NC and abstract subjects was made on the supposition of differential attention; however, the instructions given to all subjects emphasized the importance of the recall task as the main concern of the study, and may have eliminated any such differences. Results of previous experiments have been consonant with this finding (Bexton, 1953; Myers[1]).

The HumRRO studies had shown that intelligence is a relevant factor in attitude change and reaction to sensory deprivation. In two such studies (Smith, Murphy, and Myers, 1963; Murphy et al., 1963), intelligence and sensory deprivation effects interacted significantly; that is, the group of subjects below the median in intelligence consistently became much more amenable to change as a result

of sensory deprivation, while the higher-intelligence group showed only a slight effect in one study (Murphy et al., 1963) and a reverse effect in the other (Smith et al., 1963).

These findings are in accordance with structurally derived hypotheses, if one identifies the abstract group with the relatively high-intelligence subjects of the HumRRO workers and the concrete group with those of lower intelligence. Such an identification is plausible; although intelligence and abstractness are certainly not considered to be identical, many intelligence tests include items which require abstract functioning (Schroder, Driver, and Streufert, 1963), and correlations between intelligence and measures of conceptual complexity have in the past been on the order of .35-.50 (e.g., Lawrence, 1962; Streufert, 1963). In the present study, two restrictions reduced the concordance between these two variables: for one, the range of intelligence was considerably smaller than in the HumRRO subjects and the high school students used in some war-game experiments, and for another, the "abstract" group was not composed of highly abstract System IV individuals. The correlation between abstractness and intelligence was nevertheless significant; but the intelligence-level effect and the intelligence-treatment interaction were not significant in relation to attitude change.

Section IV-4. The laboratory and the prison camp: conceptual complexity and brainwashing.

The study helps to clarify some aspects of brainwashing. Some of the questions raised by the inconclusiveness of the HumRRO work seem to be answered, and the efficacy of sensory deprivation as a force impelling attitudinal compliance is supported. At the same time, the great differences between the experimental and the real-life situations must not be slighted. Experimental subjects are volunteers, who can quit at will; they undergo no physical hardship and relatively little emotional arousal - certainly much less than the persecuted, threatened captives of the real brainwasher. Furthermore, the propaganda material did not concern concepts which were central in the subject's attitude structure; in fact, not only was the affected concept peripheral, but it was carefully selected to be one towards which there was no strong pre-experimental attitude. All of these factors make the sensory deprivation chamber significantly different from the prisoner's cell - yet it should be pointed out that while the latter differences apparently make it easier for the experimenter to elicit attitude change, the former make it more difficult. It seems unlikely, therefore, that the sensory deprivation situation would be effective in changing strong attitudes about central concepts; but the combination of a less severe environment and a less important target attitude may make this type of study a relatively close analogue of the real thing.

It would be interesting to compare the conceptual structures of individuals who responded in contradictory

ways to real-life brainwashing situations. Is there a particular level of conceptual complexity which is less affected by the techniques of brainwashing than others? If so, one wonders whether the most resistant individual would be the one whose structure is simple and rigid, able to reject and ignore refuting inputs (Hunter, 1956), or the one who is flexible and information-oriented, able to adapt his behavior to the situation without the necessity to re-structure his entire belief system (Harvey et al., 1961). It may be that the optimal response to brainwashing is structural regression, and that abstract subjects would temporarily behave with less complexity than that of which they are capable. This may, in extremely threatening situations, save the existing system of values by the warding off of information which might, if considered, lead to behavior completely incompatible with that system although adaptive in the specific situation.

The widely noted "apathy" reaction of POW's in Korea has been interpreted as just such a defense - a refusal to become involved for fear of becoming convinced (Strassman, Thaler, and Schein, 1956). It is striking that the apathy syndrome was more evident in non-collaborators than in collaborators (Singer and Schein, 1958). This may indicate that it was indeed a defensive tactic which worked for those who adopted it. Its temporary nature is implied by the finding that on apathy check-lists obtained 3-5 years after repatriation, there was much less difference between non-collaborators and collaborators than there had been immediately after repatriation (Schein, Singer, and Cooley, 1962).

On the other hand, some evidence exists that non-collaborators were less active in civilian and pre-capture military life, and less intelligent, than collaborators and active resisters (Schein, Hill, Williams, and Lubin, 1957; Segal, 1957). It is therefore a possibility that active and intelligent individuals were more likely to be subjected to relatively severe pressure, to which they responded either by collaboration or by active hostility. Again, there is no evidence concerning the structural qualities of these responses, and the question of whether they represent structural regression cannot be definitely answered. It is also quite possible that all three reactions are forms of behavioral simplification; the problem then becomes to identify which was most adaptive, and the reasons why different individuals adopted different ways of dealing with the situation. It must also be remembered that very few of the prisoners of war can be classified as having evidenced attitude change: collaboration in this context refers to behavioral compliance. A similar study of civilian prisoners, who had undergone the "true" brainwashing process, would be valuable.

In pursuing this matter experimentally, two types of designs should be explored. One should add social pressure to the communicative presentation, in the style of "struggle" meetings; this might be accomplished by the use of simulated group discussions after presentation of the propaganda, with the simulated members of the group accepting the arguments which had been presented and giving arguments of their own which are in general agreement with the propaganda. The

second approach is the use of external reinforcers for behavior which is consonant with the attitude change desired - e.g., a short period of visual or auditory stimulation as reward for "correctly" answering questions about the target concept. The stimulation may in fact take the form of another item of propaganda, thus rewarding compliance with greater opportunity for future compliance. This is a technique similar to those used in programmed learning, and also to the Chinese tactic of rewarding "progressives" by allowing them access to more advanced Communist propaganda than that given to less cooperative prisoners. More prolonged confinement would presumably increase the potency of the experimental situation, although probably at the cost of a greatly increased rate of subject attrition.

A further application of structural theory in the study of brainwashing should explore the high-stimulation method of producing structural regression and attitude change. This could be done by confining the subject under conditions of intense propagandizing, combining persuasive presentations, "group" pressure, and possibly the granting of a short rest period as a reinforcer. Sleep deprivation, and punishment for non-compliant responses by intensified stimulation, are also possible maneuvers; however, care should be taken not to arrive at so close an approximation of the original technique that the subjects respond by requesting "repatriation."

V. SUMMARY

The purpose of the experiment was twofold:

a) To study the relationships among conceptual structure, environmental complexity, and behavioral complexity. These variables were analyzed on the basis of the theory of Schroder and his associates (Harvey, Hunt, and Schroder, 1961; Schroder, Driver, and Streufert, 1963). In order to evaluate the relevance of this theory to an environment of low informational complexity, sensory deprivation was used as the experimental situation. Behavioral complexity was measured in terms of attitude change in response to a persuasive communication of the argument-counterargument form, with complexity being negatively related to attitude change. Subjects of abstract (i.e., complex), intermediate, and concrete (simple) conceptual structures were included in the study.

b) To test the appropriateness of the sensory deprivation design and structural analysis for studies of brainwashing. Although a relationship between sensory deprivation and the brainwashing situation has been assumed in the past, experimental evidence was sparse and inconclusive.

Sensorially deprived subjects proved to be susceptible to the persuasive communication, showing significant attitude change in the predicted direction, whereas non-confined subjects failed to show such a change. This finding supports the proposition that sensory deprivation has effects in some ways similar to those methods which have been employed by

Communist indoctrinators and interrogators. Although there was no significant difference among the attitude changes of the different conceptual level groups in the non-confined condition, concrete subjects were significantly more susceptible to indoctrination than abstract subjects in the sensory deprivation group. In agreement with earlier reports, confined subjects evaluated the persuasive material more favorably than did non-confined subjects. There were no differences between the groups in recall of the material. No significant relationship was found between intelligence and attitude change.

It was indicated that a structural analysis of the sensory deprivation situation, and of brainwashing, is appropriate; that Schroder's measurement technique for and explanation of individual differences in terms of conceptual complexity are meaningful and predictive, and that the hypotheses derived from such a theoretical system have considerable value for postulating the relationships between individual differences and environmental stimulation in the production of the response; and that these relationships, represented by a family of curvilinear functions which have been previously established as veridical in situations providing high levels of stimulation, are also found to obtain in the low-stimulation environment of sensory deprivation.

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FOOTNOTES

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